United States Military Academy
West Point, New York 10996

RESEARCH PLAN

OF THE

DEPARTMENT OF SYSTEMS ENGINEERING

AND THE

OPERATIONS RESEARCH CENTER

FOR THE

ACADEMIC YEAR 2006

DTIC No. ADA438208

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EXECUTIVE SUMMARY

The purpose of this document is to formally present the research program of the *U.S. Military Academy Department of Systems Engineering (DSE) and the Operations Research Center for Excellence (ORCEN)* for the Academic Year 05-06. The research plan includes a statement of purpose for research which supports DSE and the ORCEN, a description of the two organizations, a list of the key personnel responsible for executing the plan, and an overview of the annual research cycle.

After this introduction, we present research summaries for applied research or problem-solving project, including Cadet Capstone Projects. Each summary includes a problem statement, a proposed methodology for project execution, project requirements and deliverables, estimates of milestones, and the number of man-years required to complete the work. Additional information is provided on the senior investigator, principal analyst or Capstone team, the client organization, and points of contact.

PART I – THE DEPARTMENT OF SYSTEMS ENGINEERING RESEARCH PROGRAM

The purpose of the research program within the Department of Systems Engineering is to support cadet education and faculty development through the organization, execution and presentation of relevant Army and Department of Defense research opportunities for significant clients.

The Department of Systems Engineering research projects provide the faculty and cadets with the opportunity to investigate a wide spectrum of interdisciplinary, systemic issues and to apply many of the systems engineering, engineering management, and operations research concepts studied in the classroom to real-world problems of interest to the Army and the Department of Defense (DoD). These projects demonstrate for both cadets and faculty the relevance and importance of systems engineering in today's high-technology military.

The research program in the Department of Systems Engineering (DSE) directly addresses four specific Academy needs.

1. Research enriches cadet education. Cadets learn best when they are challenged and when they are interested. The introduction of current issues facing the military into their curriculum achieves both. Early in their education, cadets are taught by their instructors the application of techniques to real issues and problems – issues and problems they will face upon graduation. Through this, they gain an appreciation of the robustness of the discipline and a greater understanding of their profession. As they progress in their education, they begin to apply these techniques to heretofore unsolved issues and problems. This codifies their education on the techniques and instills a adaptive, problem-solving mentality in the cadets.

2. Research enhances professional development opportunities for Army faculty. It is important to develop and grow as a professional officer in each assignment. On the DSE faculty, officers conduct research on relevant projects to remain current in their operational branch or functional areas. The research they conduct keeps them abreast of Army and DoD issues, at the forefront of their academic discipline and is returned to the classroom. They become better officers and leaders through the knowledge they gain and impart.

3. Research maintains strong ties between the Academy and Army/DoD agencies. The US Military Academy and DSE is a tremendous source of highly qualified analysts for the Army and DoD. Each faculty member holds an advanced degree in a technical discipline and has a deep understanding of the military and its issues. Research ensures that the Academy remains a significant part of the Army and DoD and not just another source of commissioning for junior officers.

4. Research provides for the integration of new technologies into the academic program. As the pace of technological advances increases, the Academy's education program must not only keep pace but must lead to ensure our graduates and junior officers are prepared

for their continued service to the Army. Research applying the most advanced technology and techniques is critical to achieving this objective.

By being fully engaged in current Army and DoD issues, the Department of Systems Engineering and the Operations Research Center assures that systems engineering education at USMA and our faculty remain current and relevant. The military's return on its investment is meaningful career development experiences for officers, especially those in Functional Areas 49/51/53/57, an enhanced education program for the USMA cadets, and important investigation of vital Army and DoD problems at far less cost than would be required through civilian contracts.

There are four aspects to the research program within the Department of Systems Engineering: The Operations Research Center of Excellence, Faculty research, Cadet Capstone research and Academic Individual Advanced Development opportunities (AIADs). Though each aspect has its own structure and scope, they are all complimentary and together support the overall DSE research program objective. Each is described in detail in the following sections.

PART II – THE OPERATIONS RESEARCH CENTER OF EXCELLENCE

The purpose of the Operations Research Center of Excellence (ORCEN) is to provide a small, full-time analytical capability to both the Academy and the United States Army and the Department of Defense. The ORCEN was established in 1990 through a Memorandum of Agreement between the Department of Systems Engineering, the Department of Mathematics (DMath) and the Office of the Assistant Secretary of the Army (Financial Management and Comptroller). Its establishment was born of the need for developing research opportunities to enrich DSE and DMath education.

Personnel authorizations in the ORCEN are established by a Table of Distribution and Allowances (TDA). Funding support for the Operations Research Center was established by a Memorandum of Agreement with the Office of the Assistant Secretary of the Army (Financial Management). The Operations Research Center is organized under the Office of the Dean as an Academy Center of Excellence. A permanent military academy professor or senior faculty member provides oversight and supervision to the Center. In addition, the TDA authorizes one O5 analyst, three O4 analysts, and a GS5 secretary. By agreement between DSE and DMath, DSE provides three analysts, an Academy Professor as the Director and one permanent staff member to serve as Executive Administrator and assistant to the Director and DMath provides one analyst.

The Operations Research Center was originally sponsored by the Assistant Secretary of the Army (Financial Management & Comptroller). Fully staffed since Academic Year 1990-1991, the Operations Research Center has made significant contributions to cadet education, faculty development, and the Army at large.

The following is a list of key personnel from the Operations Research Center responsible for executing the Research Plan for the Academic Year 2006. A detailed description of each research project is given in Part VIII - PRINCIPAL RESEARCH ACTIVITIES FOR AY06.

Table 1: Key ORCEN Personnel

TITLE & ORGANIZATION	NAME	PHONE (DSN)	EMAIL
Professor and Head, Department of Systems Engineering	COL Michael L. McGinnis, Ph.D.	688-2701	Mike-McGinnis@usma.edu
Professor and Head Department of Mathematical Sciences	COL Gary Krahn, Ph.D.	688-5285	Gary.Krahn@usma.edu
Director, ORCEN & Assistant Professor	LTC Simon R. Goerger, Ph.D.	688-5529	Simon.Goerger@usma.edu
Executive Officer & Research Coordinator	Ms. Linda Ann J. Albronda	688-5897	Linda.Albronda@usma.edu
Deputy Director, ORCEN & Instructor	LTC John Halstead, Ph.D.	688-5539	John.Halstead@usma.edu
D/SE Analyst & Instructor	MAJ Gregory Boylan, M.S.	688-3573	Gregory.Boylan@usma.edu
D/MS Analyst & Assistant Professor	MAJ Howard. D. McInvale, M.S.	688-5168	Howard.McInvale@usma.edu
D/SE Analyst & Instructor	MAJ Ernest Wong, M.S.	688-5661	Ernest.Wong@usma.edu

PART III – FACULTY RESEARCH

The Department of Systems Engineering encourages its faculty to conduct research of value for the Army and the Department of Defense during their tenure at the United States Military Academy. This specifically includes the rotating junior faculty to support their professional development.

The Department of Systems Engineering has 36 faculty members holding 22 Ph.Ds and 36 Masters Level Degrees. Additionally, there are two faculty adjunct faculty members for the Department who support research and are assigned to other organizations. Each holds their advanced degrees in disciplines which support research in systems engineering, engineering management and/or operations research. This is a tremendous research potential for significant clients within the Army and DoD.

All research in the Department of Systems Engineering is overseen by a Senior Investigator (SI) to ensure quality and completeness for the client. These Senior Investigators all hold a Ph.D. in a qualified discipline for the research project presented. Most research projects have an associated junior analyst assigned to them. This contributes to the development of the junior analyst as a researcher, the Senior Investigator as a research lead and provides the client with the best research available by the Department.

The individuals in the Department who can serve as the Senior Investigator on a research project are listed in Table 2 below. The junior analysts in the Department who can serve as the analyst on a given research project are listed in Table 3 below. Included in each table are the education background and contact information for the faculty members.

Table 2: DSE Senior Investigator

NAME	EDUCATION & DEGREE	PHONE (DSN)	EMAIL
COL Michael L. McGinnis	PhD – University of Arizona - 1995 MS – Rensselaer Polytechnic Institute – 1986 BS – USMA – 1977	688-2701	Mike.McGinnis@usma.edu
LTC William Bland	PhD – University of Virginia – 2003 MS – Florida Institute of Technology – 1995 BS – USMA – 1983	688-5181	William.Bland@usma.edu
Dr. Roger C. Burk	PhD – University of North Carolina – 1993 MS – Air Force Institute of Technology – 1985 BA – St. John's College – 1974	688-4754	Roger.Burk@usma.edu
Dr Patrick J. Driscoll	PhD – Virginia Tech – 1995 MS – Stanford University – 1989 BS – USMA – 1979	688-6587	Patrick.Driscoll@usma.edu
Dr. Bobbie Foote	PhD – University of Oklahoma – 1967 MS – University of Oklahoma – 1963 BS – University of Oklahoma - 1961	688-4893	Bobbie.Foote@usma.edu
Dr. Niki C. Goerger	PhD – Texas A&M University – 1992 MS – Mississippi State University – 1988 BS – Mississippi State University – 1986	688-3180	Niki.Goerger@usma.edu
LTC Simon Goerger	PhD – Naval Postgraduate School – 2004 MS – Naval Postgraduate School – 1998 BS – USMA – 1988	688-5529	Simon.Goerger@usma.edu
LTC John Halstead	PhD – University of Virginia - 2005 MS – Kansas State University - 1997 BS – USMA - 1986	688-5539	John.Halstead@usma.edu
LTC Robert Kewley	PhD – Rensselaer Polytechnic Institute - 2001 ME – Rensselaer Polytechnic Institute - 1998 BS – USMA – 1988	688-5206	Robert.Kewley@usma.edu
Dr. John Kobza	PhD – Virginia Tech – 1993 MS – Clemson University – 1984 BS – Washington State University – 1982	688-2788	John.Kobza@usma.edu
LTC Michael J. Kwinn, Jr.	PhD – University of Texas (Austin) – 2000 MS – University of Arizona – 1994 BS – USMA – 1984	688-5529	Michael.Kwinn@usma.edu
LTC Willie J. McFadden, III	PhD – Old Dominion University – 2000 MS – Naval Postgraduate School – 1993 BS – USMA – 1983	688-5941	Willie.McFadden@usma.edu
Dr. Gregory Parnell	PhD – Stanford University – 1985 MS – University of Southern California – 1980 ME – University of Florida – 1974 BS – State University of NY (Buffalo) - 1970	688-4374	Gregory.Parnell@usma.edu
LTC Robert Powell	PhD – Stevens Institute of Technology – 2002 MMAS – US Army CGSC – 1999 MS – George Mason University – 1995 BS – Texas A&M University - 1984	688-4311	Robert.Powell@usma.edu
LTC Rodney Roederer	PhD – Air Force Institute of Technology - 2005 MS – Colorado School of Mines - 1996 BS – USMA – 1987	688-4753	Rodney.Roederer@usma.edu
LTC Brian Sperling	PhD – Georgia Institute of Technology – 2005 MS – Air Force Institute of Technology – 1999 BS – USMA - 1989	688-4399	Brian.Sperling@usma.edu
Dr. Paul West	PhD – Stevens Institute of Technology – 2003 MTM – Stevens Institute of Technology – 2000 MBA – Long Island University – 1993 BS – State University of NY (Albany) – 1983	688-5871	Paul.West@usma.edu

Table 3: DSE Analysts

NAME	EDUCATION & DEGREE	PHONE (DSN)	EMAIL
MAJ Gregory Boylan	MS – Georgia Institute of Technology – 2003 BS – USMA – 1994	688-4753	Gregory.Boylan@usma.edu
Ms. Robin Burk	MBA – University of North Carolina – 1992 MDIV – Church Divinity School of the Pacific – 1983 BA – St. John's College – 1973	688-2746	Robin.Burk@usma.edu
CPT Paul Evangelista	MS – Rensselaer Polytechnic Institute – 2005 BS – USMA - 1996	688-3114	Paul.Evangelista@usma.edu
MAJ Gregory Griffin	MS – University of Virginia – 2005 BS – USMA – 1994	688-2668	Gregory.Griffin@usma.edu
MAJ Dale Henderson	PhD – University of Arizona – 2005 MS – Naval Postgraduate School – 1999 BS – USMA – 1989	688-4752	Dale.Henderson@usma.edu
MAJ Heidi Hoyle	MS – University of Virginia – 2004 BS – USMA – 1994	688-2073	Heidi.Hoyle@usma.edu
MAJ Robert Keeter	MS – University of Virginia – 2003 BS – USMA - 1993	688-4857	Robb.Keeter@usma.edu
LTC Brigitte Kwinn	MS – University of Arizona – 1994 BS – USMA – 1984	688-6493	Brigitte.Kwinn@usma.edu
MAJ Robert Lenz	MS – Ohio State University – 2003 BS – USMA – 1993	688-4756	Robert.Lenze@usma.edu
MAJ Travis (TJ) Lindberg	MS – University of Arizona – 2004 BS – USMA – 1995	688-4752	Travis.Lindberg@usma.edu
MAJ Howard McInvale	MS – Virginia Tech – 2002 BS – USMA – 1993	688-5168	Howard.McInvale@usma.edu
MAJ Grant Martin	MS – Georgia Institute of Technology – 2003 BS – USMA – 1994	688-5661	Grant.Martin@usma.edu
LTC Kent Miller	MS – Georgia Tech – 1994 BS – USMA – 1984	688-5578	Kent.Miller@usma.edu
CPT Michael Rainey	MS – University of Texas – 2006 BS – USMA - 1997	688-2701	Michael.Rainey@usma.edu
MAJ Thomas Rippert	MS – University of Texas (Austin) – 2003 BS – USMA – 1993	688-2510	Thomas.Rippert@usma.edu
MAJ Travis Thompson	MS – Columbia University – 2004 BS – USMA – 1994	688-4792	Travis.Thompson@usma.edu
MAJ Jason Wolter	MEM – Northwestern University – 2004 BS – USMA – 1994	688-4888	Jason.Wolter@usma.edu
MAJ Ernie Wong	MS – Stanford University – 2004 MA – Stanford University – 2004 BS – USMA – 1994	688-2668	Ernest.Wong@usma.edu

PART IV – CAPSTONE RESEARCH

The third and very significant aspect of the research program within the Department of Systems Engineering is Capstone Research. This is a year-long research project conducted by a group of 3-5 Systems Engineering and Engineering Management majors within the Department of Systems of Engineering. These projects are coordinated and lead by a Senior Investigator (holding a Ph.D.). These Capstone research projects fulfill the requirements for two of the final courses for each of these accredited majors (accredited by the Accreditation Board for Engineering and Technology).

These research projects are developed to support course and program objectives and each has a real-world client and is an "open ended" project. That means the solution is not predetermined by either the client or the research lead. This provides the cadets with the opportunity to apply the techniques they have learned in their previous courses to significant research projects. It also allows the cadets to present their work orally and in writing to clients and to other researchers at conferences.

For Academic Year 05-06 we have 17 research projects for 14 different clients. These research opportunities are listed in Part VIII of this research plan.

PART V – ACADEMIC INDIVIDUAL ADVANCED DEVELOPMENT (AIAD)

Cadets are provided with opportunities to participate in Academic Individual Advanced Development (AIAD) opportunities during their summer training months in addition to the military training required for graduation. These opportunities can fill two requirements.

1. Provide a means to conduct background research and initial problem definition for potential capstone research projects (these types of AIADs are provided for course credit), and/or

2. Expose cadets to applications of their academic program in a military or industry environment.

Each of these requirements supports the Department of Systems Engineering's educational objectives. Cadets apply the lessons they learned in previous courses to projects coordinated by clients throughout the United States and many foreign countries. This broadens the cadets' educational experience and provides a significant benefit for the clients involved.

These AIADs are normally three-weeks in length and are funded through the client or in support of other research conducted in other aspects of the Department of Systems Engineering. Though this is a relatively short stint in an organization, cadets often complete significant research projects in this time as they usually require little train-up as they are exposed to many military and academic applications prior to their arrival in a client organization and they are a very eager research source.

The list of AIAD opportunities we provided to cadets in the previous summer is listed in Part VIII of this research plan. We are always seeking new opportunities for cadets to apply their learning to client organizations.

PART VI – THE DEPARTMENT RESEARCH FOCUS

All research in the Department of Systems Engineering, including ORCEN research, supports one or more of six main research thrusts, which are described below. By requiring each research project to support one or more research thrusts, we ensure our research in DSE and the ORCEN is relevant to Army clients. We also maintain our focus on properly developing junior faculty and cadets through projects impacting their profession. The six research thrusts, in no particular order, are:

Manning the Force: This research thrust includes analysis related to the accession, development and retention of enlisted soldiers and officers in the Army. Previous clients have included Army G1, US Army Accessions Command, and Human Resources Command.

Equipping the Force: This research thrust includes analysis related to the requirement development, function requirement definition and acquisition of equipment to support Army and DoD operations. Primary clients for this thrust in particular are logically from the acquisition community. Previous clients have included PEO Soldier, PM-Future Combat Systems, Army Material Command, PM-Bradley and Army Research Laboratory.

Organizing the Force: This research thrust includes analysis related to the organizational structure of units and operations. Previous clients have included the Army Staff, Training and Doctrine Command, Army G3, Assistant Secretary of the Army (Installations and Environment), PEO Soldier, PM-Future Combat Systems and the 3rd Armored Cavalry Regiment.

Training the Force: This research thrust includes analysis related to training development and training support systems across the Army and DoD. Previous clients have included Army G3, Training and Doctrine Command, Army G8, numerous Army Divisions, including the 4th Infantry Division, and the Defense Advanced Research Projects Agency (DARPA).

Fighting the Force: This research thrust includes analysis related to doctrine and tactics for the Army and other DoD agencies. Previous clients have included Army G3, PEO –STRI, Defense/Army Modeling and Simulation Office (DMSO/AMSO), PM-Future Combat Systems and Training and Doctrine Command (TRADOC).

Sustaining the Force: This research thrust includes analysis related to the all aspects of support for the Army and DoD units while in combat, training or home-station. Previous clients have included Army G4, Surface Deployment and Distribution Command (SDDC), US Army Accessions Command, and Human Resources Command.

PART VII – THE DEPARTMENT RESEARCH CYCLE

Regardless of the research thrust, the research source or the client, each research proposal must be approved through the DSE Research Council and the Department Head. The ORCEN Director, in the role of the Department Research Coordinator, collects potential project proposals from Senior Investigators and brings the research opportunity to the Department Research Council which is headed by the DSE Department Head. This development of research opportunities is normally conducted in the summer, when the academic load wanes for our senior investigators.

At the beginning of the academic year in August, the ORCEN the research council convenes to review each research proposal for support and for the identification of required resources. The ultimate authority for approving the allocation of resources (which includes funding, lab time and analyst time) is the Head, Department of Systems Engineering. Once approved, the researchers can execute the research plan.

The Research Cycle for an Academic Year for the Department of Systems Engineering is illustrated in Figure 3. This is a depiction of the objective annual research cycle, which involves several processes in executing the Research Plan. Among them is the development of research opportunities, the approval timelines and the completion times for each project. Research opportunities can be developed during the academic year, or off-cycle. These projects are tentatively approved through the Department Research Coordinator and the Department Head. They will ultimately be required to be approved by the Research Council in their January, mid-year meeting.

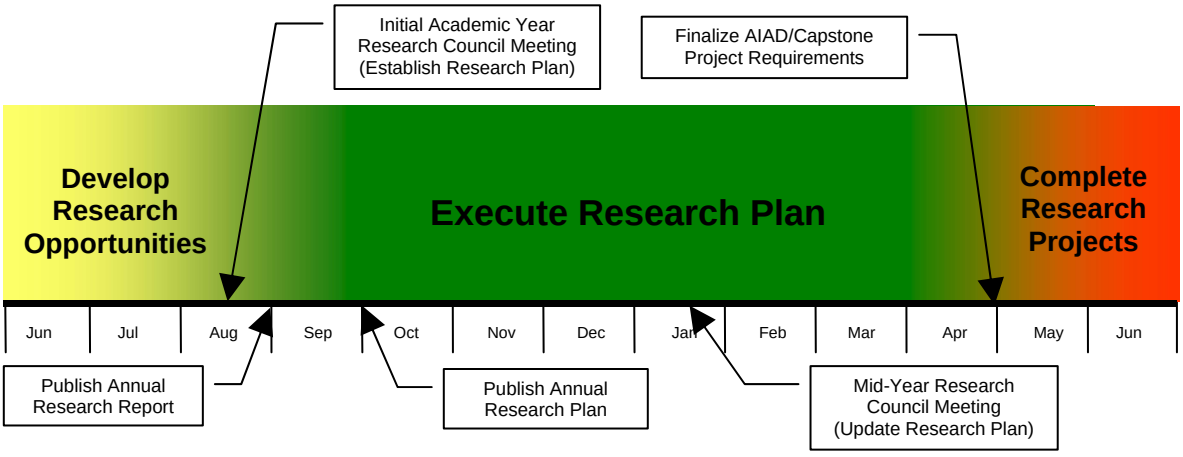

Figure 3: DSE/ORCEN Annual Research Cycle

As can be subsumed based on the cycle above and the research approval process described above, the Systems Engineering Department and the Operations Research Center do not solicit nor conduct many "short turnaround" research projects though there are some they conduct. The reason for this goes back to the initial objectives of the Department's research program, which is to support the development of the junior analysts. In the ORCEN, the analysts rotate each year. To ensure their time is used and they develop as a researcher, most projects are year-long works.

Because we seek significant, year long projects for our analysts and our Capstone cadets, the Department of Systems Engineering and the ORCEN both seek long-term client relationships. This helps ensure a steady flow of significant, open ended projects which will challenge our officers and cadets and will thereby achieve our research objectives. In the following section, we present our research activities for this current academic year.

PART VIII – RESEARCH ACTIVITIES FOR AY06

The following pages list each planned ORCEN and DSE faculty research projects to be undertaken within the Department of Systems Engineering for Academic Year 2005-2006.

Any questions regarding these problem statements should be directed to the D/SE Senior Investigator, the Principal Analyst, or the Client POC listed for the respective research project.

PART IX - AY 06 Faculty Research Program

Army Digital Terrain Library (ADTL) Phase II: Database Cataloguing, Virtual Library Interface Prototyping, and Implementation

Research Proposal No.: DSE-R-0602

Client Organization: Battle Command and Simulation Experimentation Directorate

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
LTC Scott Schutzmeister	Battle Command, Simulation & Experimentation Office (DAMO-SB) Fort Belvoir, VA	703-604-0227	Scott.schutzmeister@hqda.army.mil

Problem Description:

Terrain database generation is cost and time prohibitive. This is exacerbated by the difficulty in identifying and accessing existing terrain databases with potential for reuse. For users to assess the availability and suitability of existing terrain databases for their intended use, it is imperative that sufficient information describing the content and quality be available for review. In FY05, a phase I study produced initial concepts for ADTL structure and management along with a starter set of terrain databases. The next steps toward solution to this problem involve revisiting the client's initial problem statement of amassing a comprehensive listing of major Army terrain databases, developing a virtual library interface prototype to help provide better access and exploitation of those databases, and recommending a database host-architecture that facilitates long-term reuse of available data.

Objective:

The objectives of this study are to (a) identify major Army terrain databases that are not yet incorporated into ADTL and continuing populating ADTL with those databases, (b) designing a prototype for the virtual library interface that enhances access and exploitation of existing databases, and (c) recommending an easily maintainable host-architecture that gives users the resources to effortlessly exploit existing data. To do so effectively, we will conduct cross-walk with Army organizations to synchronize, integrate and avoid redundant efforts where possible with regards to populating and maintaining an ADTL. The scope of the work will include terrain databases based on a select group of platforms as identified with the client. Modeling and simulation systems will include but are not necessarily limited to OneSAF Testbed Baseline, OneSAF Objective System, and Joint Semi-Automated Forces.

Proposed Work:

For this research, we will first revisit the client's initial problem statement and develop a comprehensive listing of available Army terrain databases that are readily available for reuse. Although it may be infeasible to acquire a completely exhaustive list of all existing databases, we intend to amass those primarily from the client's recommendations. Not only will this effort help

us identify where database resources lie, it will also help us determine where there may be redundancy and/or gaps in coverage.

We will employ the Systems Engineering Management Process (SEMP) to develop a working prototype for the web-based interface between the ADTL virtual library and database developers and users. The SEMP is a robust, deliberate problem solving methodology taught in the Department of Systems Engineering at the United States Military Academy. It has been used widely in a variety of applications, both on military and commercial problems. The SEMP has recently been employed in development of an operational assessment system for Operation Enduring Freedom, in support of the Base Realignment and Closure (BRAC) study group, and to analyze the regional structure of the Army Installation Management Agency. For synchronization and integration and avoiding redundancy, a cross-walk with ongoing/other efforts will be performed to determine mappings, subsets, and intersections among data models to maximize ADTL's ability to ingest data from these other repositories.

The first step to address objectives a, b, and c is assessing our current inventory and management of terrain databases. We will leverage our efforts in this area with other/ongoing related efforts such as RDECOM's Synthetic Virtual Database Repository (SVDR), ERDC's terrain cataloguing efforts, the Master Environmental Library, etc. A concurrent step will be to collect information from key stakeholders for their needs. We plan to do this in a group setting. This step is followed by a functional analysis and value hierarchy design. These efforts, taken together will result in a better definition and more accurate scope of the problem. Capturing those insights will also be critical in linking this project to the initiatives spelled out by the Army Geospatial Data Integrated Master Plan (AGDIMP), as well as in anticipating future requirements. This step will be crucial in the design for the virtual library web-based interface prototype that truly does provide better access and permits exploitation of existing databases.

After collecting the information, the USMA ORCEN team will establish the procedure for the relative ranking of options for ADTL database host management—the procedures and data architecture that will be in place to account for security, incorporation of new data, updated points of contact, improvements based off of user feedback, etc. Based on this knowledge, the team will generate different alternatives for managing these databases. Each of those alternatives can be considered with respect to its contribution or connection to the AGDIMP, as well as to future systems. Finally, the team will make a recommendation the database host-architecture that facilitates long-term reuse of available data by the M&S community.

The Army is transforming to anticipate future threats. Part of that transformation involves implementing a battle command system that is network-centric and compatible/interoperable with modeling and simulation. In order to efficiently achieve that, it is necessary to create a framework for managing and organizing our terrain databases. This research will provide an enhanced baseline catalogue and recommendations for its storage location and managers.

Tasks and Issues:

Tasks to be performed and issues to address:

- Define Problem – Database Cataloguing
    - Scope problem with client in terms of databases already catalogued, obvious gaps that need to be included in the virtual library, and identification of available resources to help fill those gaps.

- Identify stakeholders and conduct needs analysis to capture ideas and issues for inclusion into the web-based interface design for easy access and retrieval into the ADTL/metadatabase and to use in data call for the continued cataloging of existing terrain databases.

- Conduct Design and Analysis of Alternatives with Stakeholders – ADTL Web-based Interface Design
    - Host stakeholder analysis and functional decomposition session(s) with focus and brainstorming questions
    - Revalidate Phase I metadata recommendations. Identify elements of terrain databases interfaces which sufficiently describe the content or make them unique. This is accomplished by conducting limited addition of terrain databases and performing searches for purpose of assessing sufficiency of metadata.
    - Develop several alternatives for data to include in a management and location assessment framework
    - Frame alternatives, based on stakeholder priorities, for presentation to those stakeholders and BCSE
- Recommend and Select Alternatives
    - Prioritize alternatives/elements, based on stakeholder input and a consideration of future requirements
    - Develop recommendations and present to clients and stakeholders
- Implement ADTL Framework – Develop and Test Interface Prototype
    - Develop ADTL user interface prototype
    - Conduct limited data call of terrain databases to test metadata and search engine capabilities
    - Use results of the data call populate ADTL
    - Develop ADTL Implementation Plans

Requirements and Milestones:

- Scope problem with client (systems on which to focus) 14 Sep 2005
- Meet key stakeholders at Simulation Interoperability Workshop to help reduce redundant efforts 22 Sep 2005
- Develop focus and brainstorming questions of needs analysis 28 Sep 2005
- Conduct needs analysis with stakeholders to determine desired capabilities 28 Sep 2005
- Conduct needs analysis with stakeholders (group sessions) 28 Oct 2005
- Develop Initial User Interface Design to input terrain database information and search catalogue for entries 4 Nov 2005

- Conduct a limited data call of existing and developing terrain databases for assessment and testing of metadata and interface usability 10 Nov 2005
- Recommend ADTL metadata and structure modifications based on database population exercises 1 Dec 2005
- Develop alternatives for ADTL host locations and management 8 Dec 2005
- Conduct IPR with BCSE to review current inventory and research to date 14 Dec 2005
- Develop prioritized list of locations and issues 13 Jan 2006
- Develop a recommendation for the framework for managing terrain databases 27 Jan 2006
- Conduct Final Briefing with BCSE with recommendations for catalogue storage locations and maintenance 15 Feb 2006

Project Deliverables and Due Date:

- Interim IPRs: 14 Dec 2005
- Recommended host location(s) for ADTL: 15 Feb 2006
- Final Briefing: 15 Feb 2006
- Technical Report: 28 Mar 2006

Senior Investigator: LTC Simon R. Goerger, Ph.D., Assistant Professor and Director, Operation Research Center of Excellence, USMA – Department of Systems Engineering, 845-983-5529.

Faculty Analyst(s): MAJ Ernest Wong, Instructor & Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5661.

Resources Required for Project:

Research Hours Required:

Senior Investigator: TBD

DoD Research Thrust:

- □ **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- **x ORGANIZING – the Force**
- **x SUPPORTING – the Force**
- □ **TRAINING – the Force**

Warfighting Centers Capabilities, Design, and Layout Project

Research Proposal No.: DSE-R-0603

Client Organization: Battle Command and Simulation Experimentation Directorate (DAMO-SB)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
LTC Scott Schutzmeister	Battle Command, Simulation & Experimentation Office (DAMO-SB) Fort Belvoir, VA	703-604-0227	Scott.schutzmeister@hqda.army.mil

Problem Description:

The Army's Transformation to Future Force and the enabling of the Future Combat System (FCS) require the ability to support battle command and embedded training with models and simulations (M&S). Current installation simulation training facilities have been developed over the decades in a manner which maximized their capabilities based on resources, technology, installation requirements, and expertise available at the time the center was built. This has created unique facilities which are non-standard across the Army making and make it more difficult to interoperate. With Network-Centric Warfare being the road to future inter- and intra-service operations, the ability to quickly modify training facilities and interoperate with other facilities in a timely manner is imperative.

Objective:

The objectives of this study are to (a) identify the desired technology and facilities layouts which would enhance inter-installation simulation center operability, (b) develop a baseline technology and facilities layout required for inter-installation simulation center interoperability, and (c) provide a framework for future development. The scope of the work will include simulation centers utilized to provide virtual simulations capabilities for training or analysis.

Proposed Work:

For this research, we propose to employ the Systems Engineering Management Process (SEMP) to identify desired technology and facilities layouts which would enhance inter-installation simulation center interoperability. Doing so will provide the basis for identifying essential infrastructure, personnel, hardware, and software required for installation simulation centers. The Systems Engineering Management Process (SEMP) is a robust, deliberate problem solving methodology taught in the Department of Systems Engineering at the United States Military Academy. It has been used widely in a variety of applications, both on military and commercial problems. The SEMP has recently been employed in development of an operational assessment system for Operation Enduring Freedom, in support of the Base Realignment and Closure

(BRAC) study group, and to analyze the regional structure of the Army Installation Management Agency.

The first step in this process is assessing current infrastructure, personnel, hardware, and software existing at installation simulation centers. This will begin to produce a listing of potential best practices. We will leverage our efforts in this area with others currently ongoing in the field such as the state-of-the-art facilities currently under development in PACOM. A concurrent step will be to collect information from key stakeholders in the modeling and simulation and training fields to include facilities modeling efforts by SPAWAR and ICT. This will be conducted in a group setting utilizing Group Systems Software as applicable. These efforts will result in a refined definition and more accurate scope of the problem. Capturing insights generated through the process will also be critical in linking this project to the PACOM effort, as well as for anticipating future requirements.

After collecting the information, the ORCEN team will be able to establish the relative ranking of options for current infrastructure, personnel, hardware, and software for installation simulation centers. Based on this knowledge, the team will generate different alternatives for assessing these items. Each of the alternatives can be considered with respect to its interoperability with current installation facilities, the PACOM facility under construction, as well as to future systems. Finally, the team will make recommendations as to the best infrastructure, personnel, hardware, and software characteristics and current/foreseeable technologies.

The Army is transforming to anticipate future threats. Part of that transformation involves implementing a battle command system that is network-centric and compatible/interoperable with modeling and simulation. In order to efficiently achieve that, it is necessary to provide installations with facilities which meet installation training and analytical needs as well as allowing installation to modify their facilities for intra and inter installation interoperability.

Tasks and Issues:

Tasks to be performed and issues to address:

- Define Problem – M&S Installation Facilities Layout
    - Scope problem with client in terms of options for M&S facilities layouts with regards to infrastructure, personnel, hardware, and software
    - Develop focus and brainstorming questions for needs analysis sessions
    - Identify stakeholders and conduct needs analysis to capture ideas and issues for possible infrastructure, personnel, hardware, and software needs of installation M&S facilities
    - Identify existing and developing installation training and analytical simulation facilities
- Conduct Design and Analysis of Alternatives with Stakeholders
    - Host stakeholder analysis and functional decomposition session(s) with focus and brainstorming questions
    - Identify essential elements of installation training and analytical simulation facilities which sufficiently describe the infrastructure, personnel, hardware, and software make them unique

    - Develop several alternatives to installation training and analytical simulation facilities layouts
    - Frame alternatives, based on stakeholder priorities, for presentation to those stakeholders and AMSO/BCSE
- Recommend and Select Alternatives
    - Prioritize alternatives/elements, based on stakeholder input and a consideration of future requirements
    - Develop recommendations and present to clients and stakeholders
- Implement M&S Installation Facilities Layout
    - Develop M&S Installation Facilities Layout Design(s)

Requirements and Milestones:

- Scope problem with client (systems on which to focus) 14 Sep 2005
- Develop focus and brainstorming questions of needs analysis 28 Sep 2005
- Identify stakeholders for installation simulation facilities layout 28 Sep 2005
- Conduct needs analysis with stakeholders to determine desired capabilities 28 Sep 2005
- Conduct needs analysis with stakeholders (group sessions) 28 Oct 2005
- Identify essential elements of simulation facilities that make them unique and functional 28 Oct 2005
- Complete visitation of installation simulation facilities 14 Dec 2005
- Develop several alternatives for simulation facilities 13 Jan 2006
- Conduct IPR to BCSE to review research to date and alternatives and assessment measures for installation simulation facilities layout 13 Jan 2006
- Develop prioritized list of facilities capabilities and layouts 17 Feb 2006
- Conduct Final Briefing with BCSE with recommendations for installation simulation facilities layout 28 Feb 2006

Project Deliverables and Due Date:

- Interim IPRs: 13 Jan 2006
- Final Briefing: 28 Feb 2006
- Listing of critical infrastructure, personnel, hardware, and software for installation simulation facilities: 4 Mar 2006
- Diagrams of functional installation simulation facilities layouts: 14 Mar 2006
- Technical Report: 28 Mar 2006

Senior Investigator: LTC Simon R. Goerger, Ph.D., Assistant Professor and Director, Operation Research Center of Excellence, USMA – Department of Systems Engineering, 845-983-5529.

Faculty Analyst(s): MAJ Gregory Boylan, M.S., Assistant Professor & Analyst, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-3573

Resources Required for Project:

Research Hours Required:

Senior Investigator: TBD

DoD Research Thrust:

- □ **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- x **ORGANIZING – the Force**
- x **SUPPORTING – the Force**
- □ **TRAINING – the Force**

High Energy Laser Weapons: Modeling and Simulations

Research Proposal No.: DSE-R-0605

Client Organization: Energy Laser Joint Technology Office (HEL JTO);

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Ed Pogue	HEL Joint Technology Office 901 University Boulevard SE, Suite 100 Albuquerque, NM 87106	(505) 248-8200	Ed.pogue@osd.mil
Glen P. Perram Professor of Physics	Department of Engineering Physics Air Force Institute of Technology 2950 P Street Wright-Patterson AFB, OH 45433-7765	(937) 255-3636 ext 4504	glen.perram@afit.edu

Problem Description:

The HEL JTO is coordinating the services' efforts to develop high-energy laser weapons. As part of this effort, the JTO recognized the need for end-to-end modeling of such weapons. Physics-based models exist for laser generation, beam formation and control, atmospheric propagation, and target interaction, but the JTO has no available model for a complete laser weapon shot ("photon birth to death"). Higher-level models of a military engagement, the execution of a military mission, or they carrying out of a campaign involving HEL weapons are also unavailable. It is clear that low-level, very detailed, physics-based models need to be linked in some way to higher-level engagement, mission, and campaign models, but it is unclear how this linkage should be worked.

To fill this gap, the HEL JTO asked the two service graduate schools of engineering (AFIT and NPS) and the three service academies (USMA, USNA, and USAFA) to form a consortium to research what modeling is required and to develop a model or family of models to meet the JTO's needs. AFIT agreed to lead this effort and the other institutions agreed to participate in ways appropriate to their capabilities and areas of responsibility.

The objectives of the effort are: (1) to develop a tri-service research team to integrate DoD fundamental research in end-to-end HEL modeling; and (2) to develop a government-owned, DoD-accepted global interface, which integrates existing and future HEL models. The initial focus must achieve a balance between (1) on-going, high-fidelity technical analyses, (2) engineering trade studies, which allow analyses of a wide range of systems, not simply a deep analysis of any one selected system, and (3) analyses of HEL systems' military utility against a broad range of missions.

The lion's share of the effort will be with AFIT, as the institution with by far the greatest expertise and experience with high energy lasers. The participation of USMA will primarily in evaluating how HELs are or should be modeled in ground warfare and air and missile defense scenarios, and in helping develop linkages from physics-based models to higher-level engagement, mission, and campaign models.

Proposed Work:

We have received and loaded a copy of Version 1.3 (May 05) of the High Energy Laser End-to-End Operational Simulation (HELEEOS), an AFIT-developed, stand-alone executable, scaling law simulation that includes platform constraints and lethality and assesses both statistical and systematic uncertainties. We propose to explore the utility of this simulator for tactical-level end-to-end studies but attempting to use it to determine how large an area could be defended from rocket, artillery, and mortar attacks by the Army's Tactical High Energy Laser (THEL).

Requirements and Milestones: TBD

Project Deliverables and Due Date: TBD

Senior Investigator: Dr. Roger C. Burk, Ph. D., Associate Professor, USMA – Department of Systems Engineering, (845) 895-2108

Resources Required for Project:

Research Hours Required:

Senior Investigator: 100 hours

DoD Research Thrust:

- □ **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

CENTCOM Casualty Data Analysis

Research Proposal No.: DSE-R-0606

Client Organization: PEO Soldier

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Charlie Tamez	US Army PEO Soldier Systems Integration Division	(703) 704-4073 DSN 654-4073	Charlie.tamez@peosoldier.army.mil

Problem Description:

Soldier-level ballistic protection is problematic for the full spectrum of Army operations. The client organization is seeking insights for developmental standards and specifications for individual ballistic protection design, based on analysis of various forms of direct and indirect fire threats soldiers encountered on recent deployments.

Proposed Work:

The Department of Systems Engineering will identify capabilities essential for a soldier ballistic protection system based on recent operational data. Specifically, DSE will:

- Conduct interviews, collect data, and perform analysis of the various forms of current direct and indirect fire threats.
- Identify threat munitions, frequency of hit, successful and unsuccessful counter measures, and other relevant survivability factors.
- Identify human factors that contribute to the degree of successful protection.

Requirements and Milestones: TBD

Project Deliverables and Due Date*:*

- Interim IPRs: December, 2005; March, 2006
- Final Briefing: June 2006
- Technical Report: July 2006

Senior Investigator: Dr. Paul West, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5871.

Number of Cadets/Number of Design Teams Involved: None

Supporting Laboratory Technician: None

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 400 hours

Lab Technician: 0 hours

Total Cadet Time: 0

Lab Use Hours: 0

Laboratory Technician Hours: 0

DoD Research Thrust:

- x **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

Transformation Theory

Research Proposal No.: DSE-R-0607

Client Organization: OFT (tentative)

Problem Description:

While transformation of military forces has received much attention in recent years, a cogent theory that explains transformational processes in the context of controllable decisions based on competitive capability is non-existent. Yet, without such a theory, strategic investment choices related to the four system components: technology, organizational structure, people and processes are made in a stovepipe fashion, without considering the interactive influences and effects they impose on overall operational capability and competitive advantage.

Existing transformation concepts envision the moving of each system component through processes that advance these components along separate avenues that appears to offer a sustained competitive advantage over adversarial forces (see Figure 1).

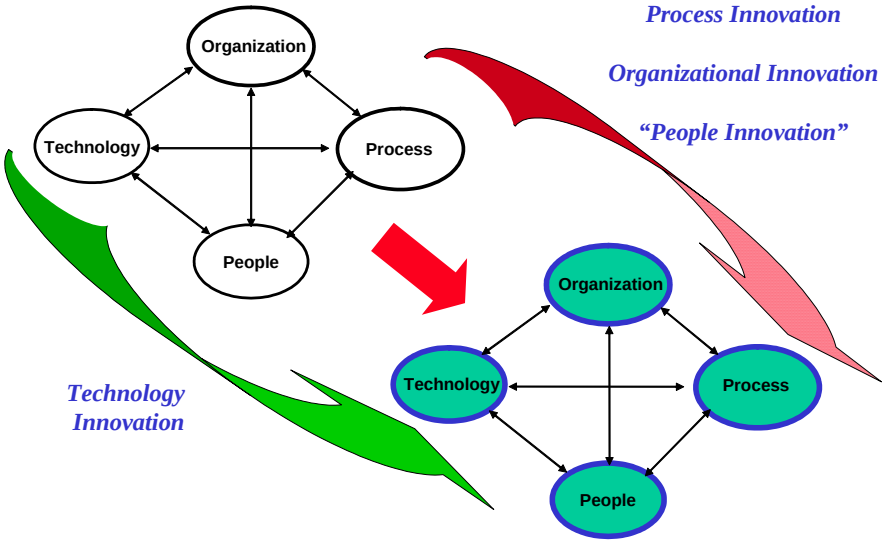

Figure 1. Dynamics of innovation on transformation components. (Gartska, 2005.)

In some cases, the advance represents sustained innovation, and in others, disruptive innovation. Regardless, successful transformation requires organizations to "purposefully create and nurture warfighting innovation as a core competency. Exactly how to do this is an open question, as is the question of how to move the inter-connective processes forward in a similar manner.

We undertake a study to develop a transformation theory that synthesizes and the current work on disruptive innovation and force transformation in order to illuminate the nature and impact of choice on competitive advantage and operational capability. Specifically, we view the interconnections of categorical choices made in technology, organizational structure, people and processes as comprising a time-dependent schema of capability that represents a force's position

on a competitive landscape. This could, under certain conditions, align with the concept of a national military strategy as it relates to force design, but this is not a necessity.

Proposed Work:

1. Objective 1: Develop a cogent theory of transformation concerning choice as it relates to the four components of force.
2. Objective 2: Integrate disruptive innovation as the result of intelligent choice schema enabling a total force capability that achieves competitive advantage.
3. Objective 3: Examine the effectiveness of using existing choice-based modeling methods to capture and explain the underlying dynamics of schema evolution.

Requirements and Milestones:

- Technical report on results due in May 2006.
- Share preliminary results at the following professional conferences in FY2004:
    - 11th ICCRTS, May 2006
    - Military Operations Research Society Symposium in June 2006

Principal Investigator: Patrick J. Driscoll, Ph.D., Professor of Operations Research, USMA - Department of Systems Engineering, 845-938-6587; Terry Pierce, Ph.D., Associate Professor, Director of the Network Information and Space Security Center (NISSC), University of Colorado, Colorado Springs, CO.

Number of Cadets/Number of Design Teams Involved: 0

Supporting Laboratory Technician: N/A

Resources Required for Project:

Research Hours Required (by position):

Senior Investigators: 100 Hours each

Lab Technician: 0

Total Cadet Time: 0

Lab Use Hours: 0

Laboratory Technician Hours: 0

DoD Research Thrust Supported: (check all that apply)

x **ORGANIZING – the Force**

x SUPPORTING – the Force

x **MANNING – the Force**

- **TRAINING – the Force**
- **EQUIPPING – the Force**
- **FIGHTING – the Force**

Discrete Characterizations of Information Reliability

Research Proposal No.: DSE-R-0608

Client Organization: TBD

Problem Description:

In previous work we demonstrated the utility of conceptualizing an information delivery means such as a common operating picture, a written or verbal report, etc. as an intentionally manufactured information product. We then characterized the essential quality components, suggested a method for representing and assessing the degree of uncertainty propagated within a digital network providing pathways for disseminating such products. However, if information products can be manufactured, then they certainly have associated life cycles that drive maintenance requirements based on condition in some dimension that lead to reliability characterizations.

We undertake a study to develop appropriate quantitative metrics for the reliability of information products, as characterized by our previous work in this area. In this instance, we intend to explore the ramifications of viewing common operating pictures and Knowledge Walls used by US Army organizations for decision support as the backdrop for experimentation. Specifically, we view the displays of these technologies as intentionally designed information products whose purpose it is to enable strong inference capability on the part of the decision maker (our technical definition of situational awareness). As such, the flow of information to particular segments of these displays is analogous to inference chains arising in the study of evidence. Moreover, the refresh rates and update processes appear to have structural similarities to renewal, or quasi-renewal processes. If this can be shown to be true, many interesting results from condition-based reliability will apply to the design considerations of these technologies.

Proposed Work:

Objective 1: Develop a system decomposition representation of select US Army common operating pictures and Knowledge Wall examples suitable for inference chain modeling.

Objective 2: Develop a Bayesian-based characterization of the processes involved in shaping and passing information through the support network feeding these technologies.

Objective 3: Examine the applicability of renewal process characterization on this network representation of the information product manufacturing environment to extend the considerations of condition-based reliability to the scheduling of refresh and update rates for these technologies.

Requirements and Milestones:

- Technical report on results due in May 2006.
- Share preliminary results at the following professional conferences in FY2004:

- Reliability and Maintainability Symposium in January 2006
- IIE Annual Conference, May 2006
- Military Operations Research Society Symposium in June 2006
- Operational Research Society (UK) in September 2006

Principal Investigators: Patrick J. Driscoll, Ph.D., Professor of Operations Research, USMA - Department of Systems Engineering, 845-938-6587; Edward Pohl, Ph.D., Associate Professor, Department of Industrial & Systems Engineering, University of Arkansas, Fayetteville, Arkansas; 479-575-6042; Joel Nachlas, Ph.D., Associate Professor, Department of Industrial & Systems Engineering, Virginia Tech, Blacksburg, Virginia, 540-231-5357.

Number of Cadets/Number of Design Teams Involved: 0

Supporting Laboratory Technician: N/A

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigators: 100 Hours each

Lab Technician: 0

Total Cadet Time: 0

Lab Use Hours: 0

Laboratory Technician Hours: 0

DoD Research Thrust Supported: (check all that apply)

- ☐ **ORGANIZING – the Force**
- ☐ **MANNING – the Force**
- ☐ **TRAINING – the Force**
- x **EQUIPPING – the Force**
- x **FIGHTING – the Force**

Simulation Roadmap for Program Executive Office (PEO) Soldier Programs

Research Proposal No.: DSE-R-0610

Client Organization: PEO Soldier

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	EMAIL:
Mr. Steve Kishok	PEO Soldier 5901 Putnam Road, Bldg 328 Fort Belvoir, VA 22060-5422	703-704-4073	Steve.Kishok@belvoir.army.mil

Problem Description:

a. Background: PEO Soldier requires a tactical combat simulation capability for Light Infantry missions at the level of platoon and below with resolution down to the individual Soldier. The simulation capability must accept, as input, scenarios and Soldier tactical mission system (STMS) characteristics. It must model the functions of the Soldier in a tactical environment, and provide, as output, the measures of effectiveness (MOEs) used to evaluate STMS. The simulation(s) will provide the analytical capability to support PEO Soldier decision making.

Given this effective need, during Fiscal Year 2004, we developed the set of specific characteristics required of such a simulation. After a thorough study of alternatives, we recommended that PEO Soldier pursue the modification of and linkage between Combat^{XXI}, IWARS, and OOS as the alternative that would best meet PEO Soldier needs. PEO Soldier supports our recommendation and has asked the Operations Research Center of Excellence (ORCEN) to begin with the implementation.

Over the course of Fiscal Year 2005, we proceeded forward with the implementation of our recommended course of action. This essentially consisted of a four-phased approach in which we strove to accomplish the following:

1) Gain Senior Joint and Army stakeholder "buy-in" whereby we worked with PEO Soldier to prepare and conduct executive-level briefings for senior Army and Joint leadership.

2) Implementation – Planning for Action: initiation of the implementation phase by establishing a dialogue with PEO Soldier organizations and simulation proponents, refining simulation requirements, estimating implementation lifecycle costs, and building a tentative execution timeline.

3) Implement the plan – Execution: worked to coordinate, mediate, and draft Memoranda of Agreement (MoA) and/or Memoranda of Understanding (MoU) between PEO Soldier and simulation proponent agencies. Additionally, we continued to work the finalization of initial funding requirements, estimates of implementation lifecycle costs, refinement of

simulation requirements, and finally to assist with development of product simulation support plans (SSPs).

4) Implementation – Supervision. This fourth phase consisted of monitoring all reports, solving issues, updating memoranda, and coordinating for and executing the independent assessment of simulation development and capability.

We executed each of these four phases over the past year, in some cases simultaneously. Currently, PEO Soldier has drafted a MOA and circulated it among the simulation proponents. While not yet signed, the simulation proponents have indicated concurrence with the contents and appear ready to proceed. All that remains is to take that step.

b. Discussion: One of the primary steps that must occur next is the actual signing of the MOA between PEO Soldier and the simulation proponents. It is this step that will serve to bring these organizations together and facilitate discussions about how best to proceed in achieving PEO Soldier's M&S objectives. Once the MOA is signed, all parties can agree to meet and discuss the next steps forward. Moreover, it is through these meetings and discussions that PEO Soldier, in conjunction with the simulation proponents, will be able to assign specific tasks and requirements to each of them. Subsequent to and based upon these assignments, we can then further determine more refined cost estimates and allocations. In determining the specific modeling requirements, PEO Soldier identified an initial set of the highest-priority products that they wish to have modeled and circulated these among the proponents for feedback with respect to level of difficulty, a projected timeline for modeling, and cost estimates. Each of the three proponents provided fairly detailed levels of information in addressing those areas for each requirement. What remains is for us to conduct a thorough refinement of those modeling requirements in order to fully capture all of the effects/impacts on soldier functions. This will require in-depth analysis of the characteristics/attributes of the STMS components being modeled, their basic effects on the soldier's battlefield functions, and the behavioral representations/adjustments that the model must incorporate. These refinements will enable the simulation proponents to move forward with their respective models. Subsequent to these activities being set in motion, PEO Soldier can then look beyond at the next set of prioritized products for the modelers to work, and we can begin the refinement process again for this new set of modeling requirements.

c. Conclusions: The Infantry soldier deserves the best equipment available in the shortest amount of time. Effective modeling and simulation (M&S) support throughout the materiel lifecycle will facilitate that timely and cost-effective fielding. The key to this M&S support is the development of an effective tool, or set of tools, available to the decision maker. By implementing the modification of and linkage between Combat^{XXI}, IWARS, and OOS to meet PEO Soldier's needs, the Army will acquire a powerful tool to support PEO Soldier decision making.

Proposed Work:

Tasks to be performed and issues to address:

1. Implement the plan – Execution

a. Finalize the Memoranda of Agreement (MoA) and/or Memoranda of Understanding (MoU) between PEO Soldier and simulation proponent agencies which include:
    - Intermediate and long-term objectives;
    - Execution timeline, to include initial set of meeting dates;
    - Critical path.
b. Finalize initial funding requirements.
c. Estimate implementation lifecycle costs.
d. Refine simulation requirements.
e. Assist with development of product simulation support plans (SSPs).
f. Provide monthly interim progress reports (IPRs) to the Deputy, PEO Soldier (DPEO Soldier).

2. Refinement of the specific modeling requirements based on the top ten products identified by PEO Soldier.
    a. Translate specific PEO Soldier product requirements into modeling requirements in order to fully capture all of the effects/impacts on soldier functions, to include the tangential impacts ranging from the individual soldier to the platoon level.
    b. Determine modeler-to-task assignments for all requirements, to include finalized cost requirements for development and implementation
    c. This will be an extension of last year's work whereby we will provide a detailed refinement of the modeling requirements spreadsheet, which will include the following:
        - Comprehensive lists of characteristics/attributes for each of the top ten products
        - The basic effects of each product (i.e., the advertised value; the effects on soldier functions; and the aggregated effects on the team, squad, and platoon level units)
        - Identification of behavioral representations/adjustments that are required as a result of the product.
3. Identification of the next ten specific modeling requirements
    a. This will begin once we have partitioned the current list of ten modeling requirements among the simulation proponents.
    b. Conduct a refinement of specific modeling requirements for these next ten products, as described in (2) above.
    c. Work with PEO Soldier and the simulation proponents in partitioning/assigning these tasks to a respective proponent and generating new cost estimates/allocations for this next level of work.

Requirements and Milestones:

Table 1. Milestones

Milestone	Date
MoA Finalized	2 Sep 05
All required MoA / MoU signed	15 Sep 05
Initial meeting w/ MoA signatories (method TBD)	NLT 30 Sep 05
Modeling tasks assigned to simulation proponents	30 Sep 05
Program Review	15 Nov 05
Refinement of modeling requirements (first set) complete;	1 Jan 06
Program Review Identify next set of products with PEO Soldier	15 Mar 06
Program Review	15 May 06
Refinement of modeling requirements (second set) complete; Modeling tasks assigned to simulation proponents	TBD
Program Review	15 Aug 06
Technical Report Complete	30 Sep 06

Project Deliverables and Due Date:

- Memoranda of Agreement / Memoranda of Understanding signed (NLT 15 Sep 05)
- Modeling requirements refinements for the first and second sets of PEO Soldier products by 1 Jan 06 and TBD respectively
- In-Progress Reviews (Monthly)
- Technical report. (30 Sep 06)

Senior Investigators: LTC Simon R. Goerger, Ph.D., Assistant Professor & Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529, Dr. Paul D. West, Ph.D., Assistant Professor, USMA - Department of Systems Engineering, 845-938-5871.

Faculty Analysts: MAJ Gregory Boylan, M.S., Assistant Professor & Analyst, Operations Research Center of Excellence, USMA - Department of Systems Engineering, 845-938-5373, MAJ Grant Martin, M.S., Assistant Professor, USMA - Department of Systems Engineering, 845-938-5663.

Number of Cadets/Number of Design Teams Involved: N/A

Supporting Laboratory Technician: TBD

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 60 Hours

Principal Analyst: 750 Hours

Lab Technician: TBD

Total Cadet Time: N/A

Lab Use Hours: Combat Simulation Lab, 80 hours

Laboratory Technician Hours: TBD

Heuristic and Exact Techniques for Solving a Temperature Estimation Model

Research Proposal No.: DSE-R-0611

Client Organization: USMA - Department of Systems Engineering; University of Arizona - Department of Industrial Engineering

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
J. Cole Smith, PhD (PhD Advisor)	Associate Professor, Industrial & Systems Engineering, University of Florida	(352) 392-1464, ext 2020	cole@sie.arizona.edu

Problem Description:

This dissertation provides several techniques for solving a class of non-convex optimization problems that arise in the thermal analysis of electronic chip packages. The topic is of interest because the performance and reliability of systems containing delicate electronic components are impacted by the thermal behavior of these systems. A modeling paradigm, called Compact Thermal Modeling (CTM) has been demonstrated to show promise for estimating thermal behavior without resorting to computationally intensive finite element models or expensive direct experimentation. The CTM is a network model which gives rise to a non-convex optimization problem. This thesis explores techniques for solving the optimization problem. We present a heuristic technique which provides reasonable quality solutions. We next present several exact approaches using a global reformulation linearization convexification technique (RLT). We then explore several approaches to improving the performance of the RLT technique. Computational results, conclusions, and recommendations for further research are also provided.

Proposed Work:

Complete dissertation defense Fall 2005, and present research at the INFORMS annual meeting in November. Submit two papers for publication in peer reviewed journals.

Requirements and Milestones:

- Defense: 7 or 10 October.
- Final Copy of Dissertation to Graduate College of the University of Arizona: 11 December.
- INFORMS conference fee cost increase: 21 October.
- INFORMS conference 16-20 November.

Project Deliverables and Due Date*:*

- Paper in International Journal of Heat and Mass Transfer (under review).

- Final Copy of Dissertation to Graduate College of the University of Arizona: NLT 11 December.
- Paper on the RLT tentatively submitted for review Spring 2006.

Senior Investigator: Roger Burk, Ph. D., Professor, USMA – Department of Systems Engineering, 845-638-4754/

Faculty Analyst(s): MAJ Dale L. Henderson, M. S., Instructor, USMA – Department of Systems Engineering, 845-638-1234

Number of Cadets/Number of Design Teams Involved: N/A

Supporting Laboratory Technician: N/A

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 4 Hours

Principal Analyst: 80 Hours

Lab Technician: 0 Hours

Total Cadet Time: 0 Hours

Lab Use Hours: 0

Laboratory Technician Hours: 0

DoD Research Thrust: (check all that apply)

- x **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- x **TRAINING – the Force**

Residential Communities Initiative (RCI) Portfolio and Asset Management (PAM)

Research Proposal No.: DSE-R-0612

Client: Deputy Assistant Secretary of the Army for Installations and Environment, Privatization and Partnerships

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Bill Armbruster	DASA for I&E, Privatization and Partnerships	(703) 692-9890	william.armbruster1@us.army.mil
Mr. Don Spigelmyer	OASAIE-RCI Director	(703) 601-2603	don.spigelmyer@us.army.mil
Mr. Sandy Clark	OASAIE-RCI PM, Portfolio and Asset Management	(703) 601-2524	Ian.clark@hqda.army.mil

Background:

The Army Residential Communities Initiative uses authorities provided in the Military Housing Privatization Initiatives Act (P.L. 104-106, Section 2801) to privatize military family housing. The Army selects private sector developers through a Request for Qualifications procurement process for purposes of improving military family housing at Army installations. The Army leases land and conveys family housing assets to a legal entity comprised of the partner and the Army. The partner constructs, renovates, repairs, maintains, and operates housing and related residential community facilities through separate service agreements with the partnership. The predominant sources of income for the project is the revenue stream from the Basic Allowance for Housing of soldiers occupying family housing units conveyed to the partnership.

The Army selects a developer by awarding a contract to prepare a Community Development and Management Plan (CDMP) for the installation. The CDMP consists of a development plan, operations plan and finance plan. It lays out a blueprint for development and management of family housing at the installation, and defines the relationship between the government and the developer for the 50-year term of the project. After approval of the CDMP by HQDA and OSD, the plan is submitted to the Congressional Defense sub-committees for a 45-day review period. Following congressional approval, the Army and partner negotiate the final legal and business agreements and ground lease terms; the partner and financial institutions agree on loan terms and conditions, and all parties conduct a real estate and finance closing. Approximately 60-90 days after congressional approval, the partner assumes operational responsibility.

Following the transition to privatization, the Army maintains a Portfolio and Asset Management (PAM) process to protect the government's interests and ensure families receive adequate housing. The PAM process tracks compliance with the CDMPs and legal business documents, by monitoring plans for construction and development, operations and maintenance, and property management. The PAM process also examines performance factors to assess the financial health and stability of each project.

The Army employs a consultant, Jones Lang LaSalle Americas, Inc. (JLL), as primary advisor to the Army from project conception to implementation. JLL provides real estate and financial

assistance to the Army in all phases of the program, including negotiating the CDMP and competing the commercial loan. JLL also helped to design the PAM process for long-term, post-privatization project oversight, and continues to provide data collection, analyses, and a broad range of advice and assistance in oversight of the portfolio of privatized housing.

The Army has executed 15 privatization agreements as of 31 December 2004. These agreements include development and management plans for over 50,000 family housing units at 21 locations in the United States. The development scope at these projects will total $5.9 billion through 2014.

Purpose: Conduct a functional evaluation of the Residential Communities Initiative (RCI) Portfolio and Asset Management (PAM) process. Provide an independent assessment of the adequacy of the Army's PAM process / program in achieving its intended objectives.

Assessment Objectives: Below lists the tasks required to be addressed in this analysis:

Task 1: To determine whether there are sufficient safeguards in all aspects and across all phases of the PAM process to prevent conflicts of interest.

a. Define conflict of interest as it relates to the RCI program
b. Where in the process could conflicts of interest occur (e.g., negotiating the original deal or negotiating enhancements) and what positions are potentially involved?
c. Is there any evidence of individuals having a conflict of interest in the PAM process?
d. What safeguards are required to prevent, identify or resolve those instances?
e. What safeguards are in place to prevent, identify, or resolve those instances
f. Are those safeguards sufficient? If not, how can they be improved?

Task 2: To assess whether the processes within RCI ensure the government gets the best value.

a. Define what factors are involved in a deal for both government and partner.
    - For example, given the structure of the deals and the constraints associated with the partner's use of the former governmental assets, should the value of the housing stock, the ground lease, and the government's cash contribution have any impact on the nature of the benefits (e.g. fees for service and return on equity) that the partner receives?
    - For example, are incentives in place to motivate the partner to seek long-term energy savings versus short-term profitability?
b. Given the factors, what constitutes best value for the government for each phase of the RCI process.
    - Prepare / Issue / Award RFQ Solicitation
    - Develop CDMP / Obtain Approvals
    - Transition to Partner Operations
    - Oversee CDMP Execution
c. What measures should be used to determine whether the government gets the best value in each of the phases of the RCI process?

d. What systems should be in place to ensure the government receives the best value in each of those phases?

e. What systems are in place to ensure the government receives the best value in each of those phases?

f. How do those systems perform relative to the established measures?

g. What changes are required to ensure that the government gets the best value in future RCI partnerships?

Task 3. To analyze the PAM process in the context of best practices compared to Real Estate Portfolio Management in the private sector.

a. Identify appropriate private or public sector organizations that have similar characteristics to RCI with respect to:
    - Real estate portfolio management
    - Government involvement (city, state, federal)

b. Understand RCI compliance and auditing processes.

c. Assess how public / private sector organizations approach Portfolio and Asset Management to achieve their stated program objectives:
    - What are the portfolio management objectives for these private or public sector organizations which correlate to RCI objectives?
    - How do they measure achieving these objectives?
    - What portfolio management systems do private or public sector organizations use to monitor performance in conjunction with the stated objectives?
    - How do these organizations monitor legal compliance?
    - How do these organizations obtain and use independent third party firms to enhance the oversight process :
        - Adherence to construction and renovation standards?
        - Control and release of funds?
        - Audits of the financial reports?
        - Governmental agency reports?

    d. How do these organizations separate the management duties of asset managers and portfolio managers?

    e. How do these organizations separate auditing duties between their portfolio managers and external auditors?

d. Assess the effectiveness of the Army's PAM program in meeting its stated objectives:
    - What are the portfolio management objectives for PAM?
    - How does the PAM process measure achieving these objectives?
    - What portfolio management systems does the RCI program use to monitor performance in conjunction with their stated program objectives?
    - How does the PAM process monitor legal compliance?

- How does the PAM program obtain and use independent third party firms to enhance the oversight process :
  - Adherence to construction and renovation standards?
  - Control and release of funds?
  - Audits of the financial reports?
  - Governmental agency reports on the PAM program or certain aspects of the PAM program?
- How does the PAM process separate the management duties of asset managers and portfolio managers?
- How does the PAM process separate auditing duties between their portfolio managers and external auditors?

e. Compare c. and d. above to determine potential enhancements to the PAM program.

Task 4. To evaluate whether the asset or portfolio management teams are adequately trained and able to perform the functions as described in the ASA (I&E) RCI PAM Handbook.

a. For the portfolio management team:
   - What are the functions of the portfolio management team as described in ASA (I&E) RCI PAM Handbook?
   - For each function, what are the areas that require training?
   - Is the training adequate for the function?
   - What additional training is required?

b. For the asset management team:
   - **What are the functions of the asset management team as described in ASA (I&E) RCI PAM Handbook?**
   - **For each function, what are the areas that require training?**
   - **Is the training adequate for the function?**
   - **What** additional training is required?

c. What is the mechanism for the asset manager to obtain assistance from the portfolio manager in the event the former requires assistance?

d. How effective is that mechanism? Are any changes needed to improve it?

Proposed Work:

Our analysis to address the tasks presented above will be accomplished in the four phases described below. These parts will be accomplished in an order deemed appropriate to accomplish the stated purpose in the proposed timeframe.

Phase I – RCI Program Overview: We will conduct extensive background research pertaining to the tasks listed above. This research will begin with obtaining a full understanding of the RCI Program from the ASA (I&E) RCI Program Office personnel.

Phase II – Background Research:

Phase IIa – Private and Public Sector
We will begin with background research of Private and Public Sector organizations that have embarked on similar privatization initiatives to determine their approach to Portfolio and Asset Management.

Phase IIb – Participant Interviews
We will conduct interviews with individuals involved in the RCI PAM process and with other individuals who can provide insight into the tasks proposed above. The objectives of these interviews will be to learn more about each participant's role in the RCI PAM program with the objective of determining if the PAM process is functioning as designed. These interviews will be conducted with asset level personnel, the partners in the program, the third party participants in the oversight process and the financial institutions that are loaning the money to the projects.

Phase III - Preliminary Findings and Recommendations: We will consolidate our information gained from Phases I through II into a list of findings and recommendations about the RCI PAM program. These findings and recommendations will be developed throughout the process and will be presented to the ASA (I&E) RCI Program Office through periodic updates in the form of Interim Progress Reports.

Phase IV - Present Final Brief and Report: Based on our findings, we will present our final report including our recommendations for future actions to be taken directly to the DASA (I&E).

Requirements and Milestones:

- Phase I - May 31st to June 15th
- Phase II – June 16th to July 31st
- Phase III – August 1st to September 30th
- Phase IV – October 1st to October 30th

Project Deliverables and Due Date:

- Initial Project briefing. June 20
- Interim IPRs: July 22nd, August 31st, September 30th and October 30th. IPR's to cover progress to date, summary of findings to date, upcoming activities including interviews, discussion topics and objectives.
- Final briefing and presentation of final report NLT 31 October 2005

Senior Investigator: LTC Robert Powell, Ph.D., Assistant Professor, USMA - Department of Systems Engineering, 845-938-4311.

Research Team: LTC Simon R. Goerger, Ph.D., Associate Professor & Director, USMA, Operations Research Center of Excellence, 845-938-5529, Dr. Patrick Driscoll, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-6587, Dr. Gregory Parnell, Ph.D., USMA – Department of Systems Engineering, 845-938-4374.

Faculty Analyst: MAJ Gregory Boylan, M.S., Assistant Professor, USMA – Department of Systems Engineering, 845-938-4753, MAJ Grant Martin, M.S., Instructor and ORCEN Analyst, USMA – Operations Research Center of Excellence, 845-938-5661

Number of Cadets/Number of Design Teams Involved: None

Supporting Laboratory Technician: Not required

Hypersonic Projectile Mission Analysis

Research Proposal No.: DSE-R-0613

Client Organization: Army Aerospace Command (RDE)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Helmut Haas	SAIC, 6725 Odyssey Dr, Huntsville, Ala, 35806	256 864 7048	Helmut.Haas@saicsystems.com
Bob Walker	BAE,310 Voyager Way,,Huntsville, Ala, 35806	256 864 2134	Bob.Walker4@baesystems.com

Problem Description:

The successful testing of SCRAM Jet technology, in March 2004, heralds a new era for flight in the commercial and military arena. This new technology has the potential to fly systems at speeds of up to mach 12. The question from an army perspective is, 'how will this capability be used best to provide a means of meeting future mission requirements of the Army?' Other questions are how do we employ and support this technology to meet Army mission requirements and what is the projected cost? How will this technology meet our problems of air defense including cruise missiles and other future difficult threats? How will and could this be used to allow the Army to keep a larger distance from the enemy in lethal engagements? Assuming a deployment time frame of 2025, what process, procedures, equipment, training, etc. would the Army need to invest in to incorporate and realize the benefits of this technology?

Proposed Work:

The Department of Systems Engineering proposes to undertake an perform the following investigative research:

1) Identify the set of feasible mission profiles that would be enhanced or met by systems with hypersonic flight capability
2) Develop potential scenarios that support the identified mission profiles
3) Define the development and employment roadmap and considerations that should be followed to fully and effectively meet the mission requirement
4) Define the complete system plan that must be followed by the Army: research and development; logistics support; training and doctrine issues, integration with existing capabilities; joint, combined and coalition issues; maintenance issues; and cost.
5) Identify the risks associated with development, fielding and employment of hypersonic flight capability.
6) Define ethical problems and issues that would hinder development of this capability.

7) Interact with study teams at Fort Bliss, Fort Sill, and Huntsville to educate out team on the continuing changes that will occur in the technology and appraise them of our findings.

Unit Funding ($K):

	FY04	**FY05**	**FY06**
HW and SW procurement	$105		
Technician support	$	$100	$120
Travel	$ 15	$ 20	$ 45
HW and SW Warranties/Upgrades	$ 15	$ 10	$ 85
Contract Personnel Support	$ 15	$ 30	$ 50
TOTAL	**$150**	**$150**	**$300**

Deliverable: This is a multi-year project expected to start in FY04 and conclude in FY06. A comprehensive report detailing the work on all six research areas stated above.

Milestones:

- Identify required software and hardware technologies — Q3 FY04
- Conduct literature review to help frame the discussion and determine the gaps — Q3-4 FY04
- Procure and install selected technology for use in analysis — Q4 FY04
- Training and support requirements for acquired technology — Q4 FY04
- Plan, conduct, analyze Delphi Group discussion to identify mission profiles — Q1 FY05
- Prepare interim report to client on identified Army mission profiles — Q1 FY05
- Develop potential scenarios supporting mission profiles — Q2 FY05
- Brief client on scenarios and refine — Q2 FY05
- Develop roadmap considerations for capability development and employment — Q3 FY05
- Database development — Q2-4 FY05
- Define the complete system plan for the hypersonic flight capability — Q4 FY05
- Plan, conduct, analyze Delphi Group II discussion on hypersonic flight capability — Q1-2 FY06
- Database development — Q2-4 FY06
- Prepare Interim Technical Report and IPR — Q3 FY06
- Identify associate risks with development, fielding and employment — Q4 FY06

- Define ethical issues Q4 FY06
- Final Technical Report and Briefing Q4 FY06

Senior Investigator: Dr. Bobbie Leon Foote, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893,

Faculty Analysts: LTC Willie J. McFadden II, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-5941, Dr. Roger C. Burk, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4754.

Number of Cadets/Number of Design Teams Involved: None.

Supporting Laboratory Technician: Mr. John Melendez, Computer Network Specialist, USMA – Department of Systems Engineering, 845-938-5872

Resources Required for Project*:*

Research Hours Required

Senior Analysts: 3 man years(includes Dr. Foote and Dr. Burk)

Investigators: 3 man years each(includes officers from the ORCEN)

Lab Technician: 3 man years(computer scientist added in 2nd year)

Condition-Based Maintenance (CBM) for U.S. Army Aviation

Research Proposal No.: DSE-R-0614

Client Organization: Army Aviation and Missile Command (AMCOM), Redstone Arsenal, Huntsville, AL 35898

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Robert Brown,	AMCOM G-3, CBM AMCOM G-3, Redstone Arsenal, Huntsville, AL 35898	256-842-8911	Robert.brown@us.army.mil
MAJ Allen Pilgrim,	Aviation Engineering Directorate AED, Redstone Arsenal, Huntsville, AL 35898	256-313-8410 DSN:788-5205	Allen.pilgrim@us.army.mil
Mr. Jason Lawler, Engineering Directorate,	Aviation and Missile Research, Development, & Engineering Center AMRDEC, Redstone Arsenal, Huntsville, AL 35898	256-867-7383	Jason.lawler@us.army.mil

Problem Description:

Condition-based maintenance is a new maintenance paradigm that AMCOM is currently introducing to help predict equipment failures based on real-time or near real-time assessments of equipment condition obtained from embedded sensors, reduce maintenance down time, and increase operational readiness by repairing or replacing system components based on actual condition of components rather than on a scheduled or time-phased basis. Currently in its incipient stages, this maintenance paradigm is already demonstrating considerable value in aircraft configured with CBM enabling technology. The Proof-of-Principal demonstrates that have taken place since July 2005 attest to the potential that CBM can have on the entire U.S. Army aviation fleet.

Proposed Work:

The Operations Research Center of Excellence (ORCEN) will provide a full-time analyst and additional faculty members to provide data modeling and architecture design, and statistical and analytical research. Potentially, the ORCEN will also involve cadets in this year's research effort. Cadet involvement is beneficial in that it exposes cadets to real Army challenges and enables them to make an impact on the future of the Army which they will serve. As future leaders this experience also gives them an insight into Army Aviation and enables them to see how CBM will affect future aviation operations. Cadets will be offered Academic Individual Advanced Development (AIAD) opportunities to work as summer interns with CBM operations both in the field and with Westar headquarters. Analysts will conduct a thorough review of existing documentation and interviews of appropriate personnel to fully understand the current CBM mission, goals and measures of effectiveness.

Requirements and Milestones:

a. Describe how the use of simulation can promote CBM capabilities that "optimize operational readiness through affordable, integrated, embedded diagnostics and [predictive] prognostics, automatic identification technology, and iterative technology refreshment" (DoD Instruction 5000.2).

   Envisioned End-Product: A white paper that describes the viability of simulation modeling to exploit CBM benefits.

   Estimated Time to Complete: 22 August 2005.

b. Refine the exploitation plan for the Analytical Data Warehouse.

   Envisioned End-Product: A detailed flow chart that diagrams how captured data turns into warehouse information that, in turn, can be analyzed and exploited as enhanced diagnostics and predictive prognostics; critical for this data architecture is an end-to-end functional decomposition of the critical processes associated with the data warehouse, an analysis on the various options available for storing, accessing, and updating the data, and a framework that best enables various stakeholders to exploit the warehouse.

   Estimated Time to Complete:

   - 29 August 2005 - Validation of Current Vision.
   - 26 September 2005 - Refined Vision.
   - 23 January 2006 - Final Vision.

c. Construct a model for the selection of future CBM components.

   Envisioned End-Product: A decision-tool or simulation model that allows stakeholders to assess the utility of various aircraft components nominated for CBM candidacy; this model will be based on factors such as, but not limited to, part criticality, part cost, part wait time, fault detectability, data availability, and prognostic viability.

   Estimated Time to Complete:

   - 24 October 2005 - Initial Model.
   - 21 November 2005 - Working Model.

d. Determine the metrics that quantify success of the CBM program.

   Envisioned End-Product: A chart that details both the challenges and benefits associated with each stage of the CBM process. Overall success will be measured against how CBM is able to "improve maintenance agility and responsiveness, increase operational availability, and reduce life cycle total ownership costs" (DUSD(LMD) Memorandum, November 2002, CBM+). This chart will eventually help to structure and describe the entire CBM process.

   Estimated Time to Complete:

   - 28 November 2005 - Initial Benefits Summary.
   - 23 January 2006 - Final Benefits Summary.

e. Construct an end-to-end description of the CBM process.

Envisioned End-Product: A process flow diagram that illustrates from foxhole to industrial base the entire CBM process. Critical will be the inclusion of a transparent feedback architecture that enables multiple stakeholders to continually assess and improve both the functionality of the data warehouse as well as the entire CBM process.

Estimated Time to Complete:

- 13 February 2006 - Proposed Framework
- 20 March 2006 - Refined Framework
- 08 May 2006 - Final Framework

Project Deliverables and Due Date:

- Expected Interim IPRs: 26SEP05, 24OCT05, 23JAN06, 20MAR06
- Final Briefing: 08MAY06
- Technical Report: 15JUN06.

Senior Investigator: LTC Simon R. Goerger, Ph.D., Assistant Professor and Director, Operations and Research Center of Excellence, USMA—Department of Systems Engineering, 845-938-5529

Faculty Analyst: MAJ Ernest Wong, M.S. and M.A., Instructor and Analyst, Operations Research Center of Excellence, USMA—Department of Systems Engineering, 845-938-5561

Supporting Laboratory Technician: None.

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 5 Hours/wk: 210 hours

Principal Analyst: 40 Hours/wk: 1680 hours

DoD Research Thrust: (check all that apply)

- x **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- x **SUPPORTING – the Force**
- □ **TRAINING – the Force**

ODAS Staff Effectiveness and Efficiency Review

Research Proposal No.: DSE-R-0615

Client Organization: Office of the Director of the Army Staff

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	EMAIL:
Ms Colleen Carey	Office of the Chief of Staff, Army 200 Army Pentagon, 3D548 Washington, DC 20310-0200	703-697-1341	colleen.carey@us.army.mil

Problem Description:

1. Background: BG Brooks, VDAS, and his staff have identified a few issues with the current staff action processes in the Office of the Director of the Army Staff. Some of these challenges include:
    a. While HQDA is an integrated staff, it is still stove-piped.
    b. Every G Staff is self contained with little cross talk/cross walk between staffs
    c. That situation/environment enables duplicative efforts particularly for many basic requirements, such as personal services
    d. Further, it does not allow for easy identification of efficiencies or effectiveness opportunities
    e. As COL Henderson, USMA Department of Mathematical Sciences, continues his study on the contract management processes in the ODAS, his course(s) of action may enhance risk(s)/impact(s) and second and third order effects. For example, consolidation of requirements, may lead to fewer large contracts which may impact the ability of Small and Disadvantaged Businesses to compete fairly for those types of opportunities.
    f. The HQDA is challenged in Information Flow --- does the HQ, USAF operate their SGS function more efficiently than the Army?
    g. Training --- HQDA questions how it should prepare people to operate in the current environment.
2. Discussion: VDAS desires a possible review of ODAS staff processes using a Lean Six Sigma training module in the curriculum. He would also like USMA to consider organizing/arranging a staff trip to the PNT as a familiarization method for those involved with this study.
3. Conclusions: VDAS request a review of the ODAS staff actions to identify possible alternatives that provide the most efficient and effective means to manage HQDA business with savings to the Army in resources (time/money/people).

Proposed Work:

Tasks to be performed and issues to address will be performed in two stages:
Stage 1 (**S: Feb '06**)

a. Review and stratify GO3 in order to frame the issue(s); adequately define all tasks and functions.

b. Identify key and sub processes in place to integrate, coordinate, and synchronize ODAS actions affecting the Army Staff.

c. Define effects based metrics to assess alternatives.

d. Determine if the ODAS is structured appropriately to support the process.

e. Identify ways (alternatives) in which to leverage technology to perform these tasks.

Stage 2 (**S: May '06**):

a. Review previous study to determine how continuity is addressed.

b. Identify processes that are in place to insure a trained a ready staff capably of effectively integrating, coordinating, and synchronizing.

c. Identify opportunities to better leverage all the information technology solutions currently available to efficiently and effectively perform the processes.

Requirements and Milestones:

- Initial meeting between primary analyst(s) and Ms Casey — o/a 26 Sep 05
- Review and stratify GO3 in order to frame the issue(s); adequately define all tasks and functions. — 15 Oct 05
- Identify key and sub processes in place to integrate, coordinate, and synchronize the Army Staff. — 01 Nov 05
- Define effects based metrics to assess alternatives. — 15 Nov 05
- Determine if the ODAS is structured appropriately to support the process. — 15 Dec 05
- Identify ways (alternatives) in which to leverage technology to perform these tasks. — 1 Jan 06
- In-Process Review — o/a 15 Feb 06
- Review previous study to determine how continuity is addressed. — 15 Mar 06
- Identify processes that are in place to insure a trained a ready staff capably of effectively integrating, coordinating, and synchronizing. — 15 Apr 06
- Identify opportunities to better leverage all the information technology solutions currently available to efficiently and effectively perform the processes. — 01 May 06
- Final Out Brief to VDAS — o/a 15 May 06
- Technical Report Complete — o/a 15 Jun 06

Project Deliverables and Due Date:

- Memoranda of Agreement / Memoranda of Understanding signed (NLT 15 Sep 05),
- In-Progress Reviews (15 Feb '06)
- Brief to VDAS, then DAS (o/a 15 May '05)
- DAS to formulate recommendations for a potential VCSA brief that will/may include:
    - Holistic changes in how we do business
    - Changes designed to not interfere or alter principals' ability to do their primary function/tasks
    - Will capitalize on efficiencies
- Technical Report. (o/a 15 Jun 06)

Senior Investigators: COL Darrall Henderson, Ph.D., Associate Professor, USMA - Department of Mathematical Sciences, 845-938-4544, LTC Simon R. Goerger, Ph.D., Assistant Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

Faculty Analysts: MAJ Howard D McInvale, M.S., Instructor & ORCEN Analyst, USMA - Department of Mathematical Sciences, 845-938-5168.

Number of Cadets/Number of Design Teams Involved: N/A

Supporting Laboratory Technician: TBD

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 40 Hours

Principal Analyst: 320 Hours

Lab Technician: TBD

Total Cadet Time: N/A

Lab Use Hours: N/A

Laboratory Technician Hours: TBD

Chaplain Deployment Assignment Tool

Research Proposal No.: DSE-R-0616

Client Organization: Office of the Chief of Chaplains, Army

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	EMAIL:
LTC Eric R. Keller	Office of the Chief of Chaplains, Army 200 Army Pentagon, 2A514A Washington, DC 20310-0200	703-693-5775	Eric.keller@us.army.mil

Problem Description:

The Office of the Chief of Chaplains is responsible for scheduling chaplains to support the religious needs of soldiers deployed as well as soldiers and family members at home station. With the current rate of deployment of active, reserve, and guard forces the demand for chaplains exceeds the chaplains available. Current means of scheduling the assignment of chaplains to deployed units has been limited to the same process utilized for years and requires consistent updates by hand.

The Office of the Chief of Chaplains has requested assistance in identify and implement a means of assigning Army chaplains to deploying/deployed units to ensure appropriate coverage of services and reduce the man hours required to develop the assignment plan.

Proposed Work:

Tasks include the analysis of the availability of chaplains (based on estimated date of completion of OBC for incoming chaplains, last date deployed, file priority, current organization, state of residence (for guard and reserve units), estimated date of retirement, and endorsement from controlling religious organization) and develop a tool to assist the Chaplin's Office in tracking and forecasting chaplains for deployment. The tasks include:

1. First, define a listing of possible of initial data calls required to assist in the initial stages of the needs analysis (o/ 15 Sept '05).
2. Second, needs analysis to identify the key stake holders, data sources, and assignment process.

   Envisioned End-Product: Process Flow Diagram of chaplain assignments, a listing of relevant data sources with metadata descriptions, and a listing of key stakeholders, their potential issues, and their desired end state.

   Estimated Time to Complete: on or about 15 October 2005.

3. Thirdly, identify possible solutions to issues raised.

Envisioned End-Product: A recommendation to the client based on a list of several viable alternatives. Options currently include a spreadsheet based system which feeds from current data bases and allows the user to generate assignments through the execution of a series of macros.

Estimated Time to Complete: 15 November 2005.

4. Fourth, develop at least one alternative into a product which can be utilized by the Office of the Chief of Chaplains to assign chaplains to deploying and deployed units.

   Envisioned End-Product: A product which allows the Office of the Chief of Chaplains to efficiently assign chaplains to units deployed or deploying to current areas of operation. The tool will take into account such issues as estimated date of completion of OBC for incoming chaplains, last date deployed, file priority, current organization, state of residence (for guard and reserve units), estimated date of retirement, and endorsement from controlling religious organization.

   Estimated Time to Complete: 15 December 2005.

Requirements and Milestones:

- Initial meeting between primary analyst(s) and the Office of the Chief of Chaplains — o/a 26 Sep 05
- Review and stratify current process in order to frame the issue(s); adequately define all tasks and functions. — 15 Oct 05
- Identify ways (alternatives) in which to leverage technology to perform these tasks. — o/a 15 Nov 05
- In-Program Review — o/a 15 Nov 05
- Process/tool to assist the Office of the Chief of Chaplains in assigning chaplains to units deployed or deploying to current areas of operation. — o/a 15 Dec 05
- Final Out Brief to the Office of the Chief of Chaplains — o/a 15 Jan 06
- Technical Report Complete — o/a 01 Feb 06

Project Deliverables and Due Date:

- Memoranda of Agreement / Memoranda of Understanding signed (NLT 15 Sep 05)
- In-Progress Reviews (15 Nov ‘05)
- Process/tool to assist the Office of the Chief of Chaplains in assigning chaplains to units deployed or deploying to current areas of operation (o/a 15 Dec ’05)
- Final Out Brief (o/a 15 Jan ‘06)
- Technical Report (o/a 01 Feb 06)

Senior Investigators: COL Darrall Henderson, Ph.D., Associate Professor, USMA - Department of Mathematical Sciences, 845-938-4544, LTC Simon R. Goerger, Ph.D., Assistant Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

Faculty Analysts: MAJ Howard D McInvale, M.S., Instructor & ORCEN Analyst, USMA - Department of Mathematical Sciences, 845-938-5168.

Number of Cadets/Number of Design Teams Involved: N/A

Supporting Laboratory Technician: TBD

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 40 Hours

Principal Analyst: 320 Hours

Lab Technician: TBD

Total Cadet Time: N/A

Lab Use Hours: N/A

Laboratory Technician Hours: TBD

Designing a Capability Based Readiness Metric for Allocating Program Funding

Research Proposal No: DSE-R-0617

Client Organization: G-8, FDA

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	EMAIL:
COL George Prohoda	G-8	7036022517	George.Prohoda@us.army.mil

Problem Description:

The readiness metric for combat units has some defects that have caused officials responsible for readiness data to call for reform. These problems include a disconnect between the readiness measurement system and the mission requirement. Further, it is hard to use the Army's readiness metric to inform the logistics community as to budget priorities in purchasing parts and systems.

Proposed Work:

A readiness system will be defined and its interfaces. An interpretation of the metric in terms of mission capability will be defined. A client interaction will be created and client objectives will be analyzed as to feasibility under this metric.

A cadet capstone team will explore how to devise a process to implement a new metric devised by MAJ Bill Kaczynski and Professor Bobbie Foote and compute the impact on readiness and mission capability.

Requirements and Milestones:

A faculty report will be presented June 1, 2006.

Cadets will present a set of reporting forms and procedures plus soft ware that evaluates the impact on mission readiness. The procedures will be completed by December 2005 and the software by May 1, 2006.

1) The reporting forms will be on Excel with demonstrations of how to link spread sheets from different bases. 2) The software to evaluate readiness will use as a base comparison index orders derived by an LP model solved by LINDO from equations written in a Word document. The client will give the rules for the current ordering policy and an evaluation in excel will compute a comparison readiness measure for the LINDO solution and the current policy.

Project Deliverables and Due Dates:

- **G-8** clients inform cadets of precise needs: September, 2005
- Interim brief: October, 2005
- Prototype delivered December, 2005
- Interim brief: February, 2006
- Beta test for G-8 end of February, 2006
- Final brief and report May 7, 2006

Senior Investigator: Dr. Bobbie L. Foote, PhD, Professor, USMA – Department of Systems Engineering, 845-938-4893.

Principal Analysts: MAJ Wiley Rittenhouse, M.S., Assistant Professor, USMA – Department of Mathematical Sciences, 845-938-5614, MAJ William Kaczynski, M.S., Assistant Professor & Executive Officer, USMA – Office of the Dean of the Academic Board, 845-938-6405

Number of Cadets: 4

Supporting Laboratory Technician: Kriste McTamaney

Resources Required for the Project:

Senior Investigator: 5 hours/week

Lab technician: 1 hour/week

System of Systems Framework Assessment Techniques

Research Proposal No.: DSE-R-0618

Client Organization: Office of the Under-Secretary of Defense (Acquisition Technology and Logistics (Defense Systems/Systems Engineering) ((OUSD(AT&L)/DS/SE)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	E-MAIL:
Kristen Baldwin	Defense Systems/ Systems Engineering Division, OUSD(AT&L), Pentagon, VA	703-695-2300	Kristen.Baldwin@osd.mil
Bob Scalamara	Defense Systems Enterprise Systems Engineering Division OUSD(AT&L), Pentagon, VA		
Dave Castellano	Assessments Support Division OUSD(AT&L), Pentagon, VA		

Problem Description:

The traditional weapon systems integration process is vertical in which technologies are developed, evaluated, selected and optimized for a specific platform and battlefield need. The Department of Defense (DoD) is now adopting a joint capabilities development approach, each Service is moving in the direction of interchangeable forces, such as Carrier Battle Groups, Air and Space Expeditionary Forces, and Modular Brigades. Individual systems are being assessed in their context of use and relationships to other complementary systems that comprise a System of Systems (SoS), or a capability package. The changing mission requirements and the need for agile combat units that are configured to meet complex and changing battlefield conditions and necessities requires the development of newer methodologies and tools for engineering baffle group platforms effective in meeting warfighter needs.

In order to address this need, OSD together with Stevens Institute of Technology, West Point and other experts in the field are developing a large-scale complex systems evaluation, architecture methodology synthesis and optimization framework. The effort will draw upon current complex acquisitions, such as the Army's Future Combat Systems, the DoD Single Integrated Air Picture, and Integrated Air and Missile Defense.

Other considerations: Work will be conducted in cooperation with relevant DoD partners and existing related methodologies such as developed by MITRE, DAC, ARDEC and others as deemed necessary.

Proposed Work:

Engineers and Systems Analysts face the ever increasingly difficult task of developing complex systems that are integrated to work seamlessly with other complex systems. Additionally, these systems must have open architectures to facilitate their integration with systems being developed and future systems not even on the drawing board. The implications of designing, integrating and evaluating System of Systems architectures and performance present perplexing problems

for our engineers, analysts and decision makers. No longer can analysts look at a complex system in isolation, but rather they must conduct their analysis (resource, trade space, mission, etc.) in the context of a meta-analysis to provide the decision maker with the breadth of options and risks based on his or her decision. Nowhere is this problem more acute than in the Department of Defense, where large complex systems are being developed that must support legacy forces, future forces, joint operations and coalition operations.

This study is meant to develop a framework or methodology focused on the technical planning/allocation of the program execution process with emphasis on engineering tasks. Included in this study is an assessment of the key technical drivers for complex systems and mapping these assessments to the meta-system or SoS. Additionally, this effort will develop a framework that maps program technical drivers (such as T&E, configuration management, process, SE, etc.) against program characteristics (such as complexity, schedule constraints, maturity, development vs. non-development). These characteristics, based on risk assessment and mitigation, will relate to recommended units ($, personnel, facilities, etc) of technical driver resources. In light of the findings the effort will address the existing OUSD(AT&L) *5X5* matrix developed to evaluate program systems engineering, and recommend improvements in it's structure.

Requirements and Milestones:

- A literature review will be conducted to identify acquisition program technical drivers.
  - Query selected PMs for their input on key drivers effecting their programs
  - Identify technical drivers unique to System of Systems (SoS).
- Coordinate with Stevens Institute team to use definition/characteristics of (SoS) developed through their research
- Identify program characteristics associated with SoS (focus on program performance measure (cost, schedule, performance) then expand where necessary.
- Develop methodology and identify the tools which will enable decision makers to understand the effects on program performance at the SoS level due to technical driver resource decisions.
- Identify and demonstrate the methodology via the Single Integrated Air Picture (SIAP) program.
- Incorporate the methodology and tools into the existing OUSD (AT&L) *5X5* matrix designed to evaluate program systems engineering.

Project Deliverables and Due Date*:*

- Literature review identifying acquisition program technical drivers (Nov 05).
- Methodology and tools enabling decision makers to effect program performance at the SoS level (Feb 06).
- Recommendations and improvements to the OUSD (AT&L) *5X5* matrix (Mar 06).
- Technical Report on project findings (May 06).

Sr. Investigators: LTC Willie J. McFadden, Ph. D., Associate Professor, USMA – Department of Systems Engineering, 845-938-5941,. Dr. Niki M. Goerger, Ph.D., Visiting Professor, ERDC/USMA – Department of Systems Engineering, 845-938-3180.

Supporting Laboratory Technician: Mr. John Melendez, Mr. Maxim Serebrennik

Resources Required for Project*:*

Research Hours Required (by position):

Main Investigator: 2/3rd person year

Investigator: 1/6th person year

Lab Technician: 1/12th person year

Lab Use Hours: 80 hours; I expect to use the LAMi laboratory resources, specifically the Information Visualization laboratory (IVL) and Acquisition management & Systems Design (AMSD) Laboratory.

Laboratory Technician Hours: See above

Armed Forces-CARES: Armed Force Casualty Assistance Readiness Enhancement System

Research Proposal No.: DSE-R-0619

Client Organization: Army Casualty and Memorial Affairs (HRC)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	EMAIL:
COL Mary Torgersen Director	Army Casualty and Memorial Affairs (HRC) Washington, DC 20310-0200	703-325-7777 DSN (221)	torgeml@us.army.mil

Problem Description:

To help enhance the process for those assigned the responsibility of being of Casualty Assistance Officer (CAO) so that the primary next-of-kin (PNOK) of deceased soldiers and retirees get timely and responsive assistance.

Methodology:

First, define all the possible courses of action that a Casualty Assistance Command (CAC) and CAO may have to contend with in the event of a soldier or retiree's death. This will entail a functional decomposition of AR 600-8-1, Army Casualty Operations/Assistance/Insurance, DA Pam 608-4, A guide for Survivors of Deceased Army Members, and DA Pam 600-5, Handbook for Retiring Soldiers and Their Families.

Envisioned End-Product: A flow chart that diagrams all possible scenarios that the CAC and CAO may face. This flow chart will help ensure all possible resources, tools, and requirements are considered for the project.

Estimated Time to Complete: 20 September 2005.

Second, construct an aid that streamlines the processing of paperwork associated with the casualty assistance program.

Envisioned End-Product: A software package, preferably based on existing applications that are widely-available (such as Adobe Acrobat or Microsoft Excel), that makes it very easy for an assigned CAO to execute his or her duties.

Estimated Time to Complete: 25 November 2005.

Third, identify the most appropriate method for enabling CACs and CAOs to gain access to this aid.

Envisioned End-Product: A recommendation to the client based on a list of several viable alternatives. Options currently include a CD-ROM, link to the U.S. Army portal, or a self-contained website and server.

Estimated Time to Complete: 20 January 2006.

Fourth, conduct stakeholder analysis with agencies external to the Department of Defense in order to determine feasibility of linking and further automating benefits and entitlements process.

Envisioned End-Product: Upgrade to software package (alpha version) that enables automated and paperless processing to external agencies such as Department of Veterans Affairs, Internal Revenue Service, and Social Security Administration.

Estimated Time to Complete: 20 March 2006.

Fifth, contract with software developer to produce fielded test software package (beta version).

Envisioned End-Product: Software package that enables select users to test the viability of the product and to identify improvements to the system.

Estimated Time to Complete: 26 June 2006.

Sixth, contract with software developer to produce fielded software package (release version of AF-CARES 1.0).

Envisioned End-Product: Software package that is delivered to CACs and CAOs for field use.

Estimated Time to Complete: 21 August 2006.

Lastly, conduct a software usability study to identify needed changes to package and complete software development package and technical report (release version of AF-CARES 1.0 Documentation).

Envisioned End-Product: Software development package and technical report for AF-CARES 1.0 delivered to Army Casualty and Memorial Affairs (HRC) with results of usability study, software requirements documentation, and software architecture.

Estimated Time to Complete: 31 December 2006.

Milestones:

- Conduct Initial Program Telecon with CAO staff — 14 Aug 2005
- Develop focus and brainstorming questions for needs analysis — 20 Aug 2005
- Identify stakeholders for catalogue storage and potential usability study — 25 Aug 2005
- Conduct Initial Program Meeting with CAO staff — 14 Sep 2005
- Deliver Process Flow Chart of Possible CAO Scenarios to HRC for review — 20 Sep 2005
- Conduct needs analysis with stakeholders (group sessions) — 20 Oct 2006
- Provide Software Package (Adobe Acrobat/Microsoft Excel) Armed Forces-CARES 0.1 to HRC — 25 Nov 2005
- Develop prioritized list of locations and issues — 18 Dec 2005
- Conduct In-Progress Review Briefing (Product Implementation Recommendations) — 20 Jan 2006

- Provide Software Package for Armed Forces -CARES Alpha to HRC and test participants — 20 Mar 2006
- Conduct In-Progress Review Briefing (Armed Forces -CARES Alpha) with HRC — 15 Apr 2006
- Provide Software Package for Armed Forces -CARES Beta to HRC and test participants — 26 Jun 2006
- Conduct In-Progress Review Briefing (Armed Forces-CARES Beta) with HRC — 01 Aug 2006
- Provide Software Package for Armed Forces -CARES 1.0 to HRC — 21 Aug 2006
- Conduct Armed Forces -CARES 1.0 Usability Study — 15 Sep 2006
- Conduct Final Briefing with HRC — 15 Nov 2006
- Provide Software Development Package for Armed Forces –CARES 1.0 to HRC — 31 Dec 2006
- Provide Technical Report for Armed Forces -CARES 1.0 to HRC — 31 Dec 2006

Project Deliverables and Due Date*:*

- Initial Program Meeting with CAO: 14 September 2005.
- Process Flow Chart of Possible CAO Scenarios: 20 September 2005.
- Software Package (Adobe Acrobat/Microsoft Excel) AF-CARES 0.1: 25 November 2005.
- In-Progress Review Briefing (Product Implementation Recommendations): 20 January 2006.
- Software Package AF-CARES Alpha: 20 March 2006.
- In-Progress Review Briefing (AF-CARES Alpha): 15 April 2006.
- Software Package AF-CARES Beta: 26 June 2006.
- In-Progress Review Briefing (AF-CARES Beta): 01 August 2006.

a. Software Package AF-CARES 1.0: 21 August 2006.

- Final Briefing: 15 November 2006.
- Software Development Package for AF-CARES 1.0: 31 December 2006.
- Technical Report for AF-CARES 1.0: 31 December 2006.

Senior Investigators: LTC Simon R. Goerger, Ph.D., Assistant Professor and Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5529.

Faculty Analysts: MAJ Ernest Wong, M.S., Instructor, Operations Research Center of Excellence, USMA - Department of Systems Engineering, 845-938-5661.

Number of Cadets/Number of Design Teams Involved: N/A

Supporting Laboratory Technician: TBD

Laboratory technician will be hired or contracted by the Department of Systems Engineering to create AF-CARES based on software operational requirements and needs analysis for AF-CARES Alpha, Beta, and the final release version of the software package.

Future Force Warrior Analytical Support

Research Proposal No.: DSE-R-0620

Client Organization: Program Manager, Future Force Warrior

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Bill Harris	Future Force Warrior Integrated Analysis Co-lead, TSM Soldier, Fort Benning, GA 31905	(706) 545-6826	william.harris@benning.army.mil
Mr. Bob O'Brien	Future Force Warrior Systems Engineering Co-lead, NSC, Natick, Massachusetts 01760	(508) 233-4924	robert.obrien@natick.army.mil
Ms. Carol Fitzgerald	Program Manager, Future Force Warrior, NSC, Fort Belvoir, VA 22060	(703) 704-1427	carol.fitzgerald@peosoldier.army.mil

Problem Description:

To support its transformation to a soldier centric force, the Army is developing and demonstrating future transformational capabilities for the "soldier as a system" using an incremental, System of Systems (SoS) approach. The Future Force Warrior (FFW) Advanced Technology Demonstration (ATD) program demonstrates the feasibility of desired soldier and Small Combat Unit (SCU) capabilities. Notional concepts that might be developed include head to toe individual protection, netted effects, soldier worn power sources, soldier battlefield applications, and enhanced human performance. The FFW program is researching how to improve the combat effectiveness of the soldier in the 2010 time frame.

As an ATD program, FFW is focused on identifying value added technologies (specifically Land Warrior Advanced Capability) for the soldier as a system and on refining the capabilities described in the Ground Soldier System Capabilities Development Document. As value added technologies are identified, individual technologies may be transitioned to the Land Warrior-Stryker Interoperability program or the current force before the ATD is completed.

Although the FFW ATD is not an acquisition program, FFW supports Land Warrior (LW) block III. Analysis is being done to determine the appropriate capabilities to recommend for LW block III and to assess the utility of emerging technologies in improving combat effectiveness of the soldier and small combat units.

As an important part of this program, the Analysis and Experimentation (A&E) team will perform operational analysis, which includes exploratory, operational power and energy, and Soldier Battle Lab (SBL)/Soldier in the Loop (SITL) analyses. Analysis processes focus on model-test-model and exploratory analysis.

Information systems are at the core of the FFW simulation and analysis problem. However, current information capabilities and emerging information technologies are not easily modeled. Considering current analysis methods, the advantages of potential information systems capabilities over existing capabilities are difficult to determine. Current difficult analysis issues include:

1) What does each leader and soldier need to know (and when) to affect decision-making in order to enhance combat effectiveness?
2) What are the primitives of this information knowledge that need to be modeled in order to conduct exploration of information technologies as an independent and dependent capability?
3) How can distribution of this information be modeled without devolving into an engineering-level analysis of communications systems? and
4) What are appropriate measures of effectiveness to use to assess improved information superiority?

Proposed Work:

The Operations Research Center of Excellence (ORCEN), Systems Engineering Department at the United States Military Academy will provide an individual to serve as the Government co-lead of the A&E Team for FFW with an individual assigned as the Contractor co-lead from General Dynamics C4 Systems, the FFW Lead Technology Integrator (LTI). Duties include:

- Assistance with experimentation
- Assistance with analysis and analysis strategy
- Advise and provide technical assistance to analytical proponents (mainly SAIC)
- If necessary, liaison with TRAC Monterey and WSMR
- Participate in LTI evaluation activities
- Participate in open reviews and other periodic reviews and activities
- Support activities leading to the analysis, evaluation, and acquisition of the FFW System of Systems
- Participate in ongoing development of technical and operational exit criteria

Senior Investigator and Primary Analyst: LTC John B. Halstead, Ph.D., Assistant Professor and Deputy Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-5539.

DoD Research Thrust:

- x **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

PART X - AY06 Capstone Research Program

Designing a Capability Based Readiness Metric for Allocating Program Funding

Capstone Research Proposal No: DSE-CR-0601

Client Organization: G-8, FDA

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
COL George Prohoda	G-8 Army Pentagon Washington, DC	7036022517	George.Prohoda@us.army.mil

Problem Description:

The readiness metric for combat units has some defects that have caused officials responsible for readiness data to call for reform. These problems include a disconnect between the readiness measurement system and the mission requirement. Further, it is hard to use the Army's readiness metric to inform the logistics community as to budget priorities in purchasing parts and systems.

Proposed Work:

A cadet capstone team will explore how to devise a process to implement a new metric devised by MAJ Bill Kaczynski and Professor Bobbie Foote and compute the impact on readiness and mission capability.

Requirements and Milestones:

Cadets will present a set of reporting forms and procedures plus soft ware that evaluates the impact on mission readiness. The procedures will be completed by December 2005 and the software by May 1, 2006.

1) The reporting forms will be on Excel with demonstrations of how to link spread sheets from different bases.
2) The software to evaluate readiness will use as a base comparison index orders derived by an LP model solved by LINDO from equations written in a Word document. The client will give the rules for the current ordering policy and an evaluation in excel will compute a comparison readiness measure for the LINDO solution and the current policy.

Project Deliverables and Due Dates:

- G-8 clients inform cadets of precise needs September, 2005
- Interim brief October, 2005
- Prototype delivered December, 2005

- Interim brief — February, 2006
- Beta test for G-8 — end of February, 2006
- Final brief and report — May 7, 2006

Senior Investigator: Dr. Bobbie Leon Foote, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893.

Number of Cadets: 4

Supporting Laboratory Technician: Kriste McTamaney

Resources Required for the Project:

Senior Investigator: 5 hours/week

Total Cadet Time: Approximately 1400 hours

Lab technician: 1 hour/week

DOD Research Thrust:

- x **EQUIPPING – the Force**
- □ **FIGHTING –the Force**
- □ **MANNING- the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

Leaders Tactical Medical Monitoring Collective (LTM2C)

Capstone Research Proposal No.: DSE-CR-0602

Client Organization: Center for Economic Growth, Albany, NY 12207

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Kurt Keville	SDC Coordinator/Research Specialist Institute for Soldier Nanotechnologies Massachusetts Institute of Technology Building NE47, 4th Floor 77 Massachusetts Avenue Cambridge, MA 02139	617-324-6422	kkeville@mit.edu
Mr. Simon Balint	Program Director, Technology Center for Economic Growth (CEG) 63 State Street Albany, NY 12207	518-465-8975 Ext 240	simonb@ceg.org
Mr Bruce Hodge	Tech Valley Technologies, Inc. Watervliet Arsenal 44 Dalliba Avenue Watervliet, NY 12189	518-893-7285	bhodge@techvalleytech.com

Problem Description:

In order to enhance mission effectiveness during tactical operations, it is essential that leaders have the ability to monitor the real-time health and welfare status of individuals under their command. This information is necessary for making critical leader decisions in the face of life threatening situations. While this research issue was originally framed in a military context, it is also relevant for situations involving first responders and law enforcement personnel.

A system that could address this problem would likely have several components: a data collection subsystem, a data repository, a GPS tracking subsystem, a wireless communication subsystem, a user interface, and decision support system, and perhaps others. Research is ongoing in a number of these areas, but not much is being done yet to address the overall solution. For example, a suit is being developed that uses an embedded sensing membrane and GPS tracking system to monitor the wearer's medical status and location and then transmit the information to a central controller.

This research will use the Systems Engineering and Management Process (SEMP) to conduct a thorough analysis of the problem, with a focus on a system-of-systems solution. We intend to take advantage of Commercial Off-The-Shelf (COTS) or Government Off-The-Shelf (GOTS) components where applicable and develop other components as needed. In addition, a large part of the effort will be in defining and developing the overarching data repository and decision support system.

This project is intended to follow up on work initiated in the Lifecycle Acquisition Management Institute (LAMi) to theorize a solution to this problem as a proof of principle of LAMi capabilities.

Proposed Work:

- Investigate the problem area and develop a study plan.
- Conduct a literature review to survey current research in related technologies.
- Define the information requirements for a solution to the problem.
- Develop several courses of action for the proposed LTM2C, to include software, hardware, and procedural solutions.
- Identify the "best" approach and develop a plan to implement this solution at the Soldier Design Competition (SDC) hosted by the Massachusetts Institute of Technology (MIT).
- Prepare a briefing for presentation during the USMA Projects Day on 4 May 2006.
- Prepare a written technical report with an executive summary and documentation of the design team effort (endnotes and bibliography).

Requirements and Milestones:

- IPR #1: o/a 29 Sep 05
- SDC Proposal Due 12 Oct 05
- IPR #2: o/a 1 Nov 05
- SDC Description Due 5 Nov 05
- Semifinal SDC Judging 16 Nov 05
- IPR #3: o/a 2 Feb 06
- Final SDC Judging 1 Mar 06
- IPR #4: o/a 30 Mar 06

Project Deliverables and Due Dates:

- Final Briefing: 4 May 06
- Technical Report: 12 May 06

Senior Investigator: LTC William S. Bland, Ph. D., Assistant Professor, USMA – Department of Systems Engineering (845) 938-5181.

Number of Cadets/Number of Design Teams Involved: A cadet design team consisting of one Information Systems Engineering major, one Operations Research major, one Systems Engineering major, and one Engineering Management major.

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator/Principal Analyst: 400 hours (4 hrs/wk for 2 semesters)

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: 40 hours (CAC Card and ISM experimentation)

Laboratory Technician Hours: 4 hours (CAC Card and ISM software installation)

DoD Research Thrust Supported: (check all that apply)

- ☐ **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- ☐ **MANNING – the Force**
- ☐ **ORGANIZING – the Force**
- x **SUPPORTING – the Force**
- ☐ **TRAINING – the Force**

CAC Card In- and Out-Processing

Capstone Research Proposal No.: DSE-CR-0603

Client Organization: Office of the Adjutant General, West Point, NY 10996

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
COL Brian Crawford	Garrison Commander West Point, NY 10996	645-938-2022	Brian.Crawford@usma.edu
LTC Bill Macken	Adjutant General West Point, NY 10996	845-938-3402	William.Macken@usma.edu
Ms. Pam Lozell	Chief, Military Personnel Division West Point, NY 10996	845-938-8452	Pamela.Lozell@usma.edu
Ms. Earl Vass	Supervisor, Personnel Processing Branch West Point, NY 10996	845-938-8474	Earl.Vass@usma.edu
Ms. Laura Perez	Supervisor, Personnel Services Branch West Point, NY 10996	845-938-8489	Laura.Perez@usma.edu

Problem Description:

Upon arrival at an installation/community, military and civilian personnel are required to complete in-processing within five duty days. Prior to departure, they are required to clear all installation/community organizations in order to resolve any outstanding debts owed to the US Government and prepare for transition. Specific requirements for both in- and out-processing are described in AR 600-8-101.

The US Army has a set of standardized software applications that perform day-to-day sustaining base functions such as personnel processing, education records management, and central issue. These installation support modules (ISMs) are currently being upgraded into Web-enabled systems that will improve user access, enhance capabilities, and help reduce cost. Installations are required to use the ISM out-processing module to the maximum extent possible.

The Common Access Card (CAC) is the Federal Government's effort to update the military and defense employee identification system. The CAC Card is basically a smart card with several functions -- literally combining several cards into one. In addition to replacing the existing DoD identification card, it will be the principal card used to enable physical access to buildings and controlled spaces; the principal card used to enable computer network and system access; and will be needed to provide electronically signed e-mail correspondence and access to certain DoD Web sites.

Oftentimes, the in-processing and out-processing experience is confusing, arduous, and time consuming. This research will investigate whether incorporating the CAC Card into the in- and out-processing mechanism can further automate and simplify the process and if so, how to best implement the CAC Card with the appropriate ISMs.

Proposed Work:

- Investigate the problem area and develop a study plan.
- Conduct a literature review to better understand the in- and out-processing requirements specified in AR 600-8-101, the CAC Card, and ISM functions.
- Interview Personnel Service Center (PSC) personnel at various installations to identify current methods of implementing in- and out-processing procedures (the SEMP "descriptive scenario") and insights into the "optimal" implementation (the SEMP "normative scenario").
- Assess the feasibility of incorporating the CAC Card into the in-and out-processing mechanism.
- Develop several courses of action, to include software, hardware, and procedural solutions.
- Identify the "best" approach and develop a plan to implement this solution at West Point. Include plans for a trial run of the solution for the upcoming 2006 faculty turnover period and potentially exporting this solution to the rest of the DoD if the trial run is successful.
- Prepare a briefing for presentation during the USMA Projects Day on 4 May 2006.
- Prepare a written technical report with an executive summary and documentation of the design team effort (endnotes and bibliography).

Requirements and Milestones:

- IPR #1: o/a 13 Oct 05
- IPR #2: o/a 1 Dec 05
- IPR #3: o/a 2 Feb 06
- IPR #4: o/a 30 Mar 06

Project Deliverables and Due Dates:

- Final Briefing: 4 May 06
- Technical Report: 12 May 06

Senior Investigator: LTC William S. Bland, Ph. D., Assistant Professor, USMA – Department of Systems Engineering (845) 938-5181.

Number of Cadets/Number of Design Teams Involved: A cadet design team consisting of one Information Systems Engineering major, one Systems Engineering major, and two Engineering Management majors.

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator/Principal Analyst: 400 hours (4 hrs/wk for 2 semesters)

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: 40 hours (CAC Card and ISM experimentation)

Laboratory Technician Hours: 4 hours (CAC Card and ISM software installation)

Department Research Thrust Supported: (check all that apply)

- □ **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- x **SUPPORTING – the Force**
- □ **TRAINING – the Force**

Determining the Top Hazards in Army Ground Vehicle Operations

Research Proposal No.: DSE-CR-0604

Client Organization: Combat Readiness Center

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Bruce Jaeger, PhD	Combat Readiness Center, Ft. Rucker, AL		bruce.jaeger@us.army.mil

Problem Description:

In order to integrate the Army's risk management process, as outlined the Army's field manual for risk management, and the Director of Army Safety's (DASAF) values into the Combat Readiness Center's resource allocation procedures, a methodology to consistently and accurately determine the top hazards in Army ground vehicle operations is required. Upon determining the most severe hazards resources may then be appropriately and optimally allocated.

The objective of this research is to incorporate the values of the Army and its current decision-makers into a systematic, logical decision structure which analyzes existing hazards and develops a list of the most severe hazards in Army ground vehicle operations.

Proposed Work:

A value hierarchy will be the basis for developing alternatives and evaluating the worth of different solutions, such evaluation will facilitate making the tough tradeoffs by making them more explicit. Some of the associated sub-objectives are:

1) Structure a quantified model that represents Army Doctrine and the Combat Readiness Center's values with respect to ground vehicle operations.
2) Identify the most severe ground vehicle accidents.
3) Identify the highest risk accidents.
4) Prioritize by severity the hazards causing ground vehicle accidents

Requirements and Milestones: TBD

Project Deliverables and Due Date:

- Interim IPRs: One per semester, expected dates: October, 2005 & March 2006.
- Final Briefing: Due date, May, 2006.
- Technical Report: Due date, May, 2006.

Senior Investigator: LTC Brian Sperling, Ph. D., Assistant Professor, USMA – Department of Systems Engineering, (845) 938-4399

Faculty Analyst(s): TBD

Number of Cadets/Number of Design Teams Involved: 4 cadet design team

Supporting Laboratory Technician: TBD

Resources Required for Project*:* TBD

Research Hours Required (by position):

Senior Investigator: TBD

Principal Analyst: TBD

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: TBD

Laboratory Technician Hours: TBD

DoD Research Thrust: (check all that apply)

- □ **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- **x** **SUPPORTING – the Force**
- □ **TRAINING – the Force**

First Term Dental Readiness (FTDR) Phase 2

Capstone Research Proposal No.: DSE CR-0605

Client Organization: U.S. Army Dental Activity (DENTAC) – Fort Benning, GA

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Matthew T. Williams	DENTAC, Fort Jackson, SC	803-467-1527	Matthew.Williams1@se.amedd.army.mil
COL Larry Rothfuss	HQ, MEDCOM	210-221-7899	Larry.rothfuss@cen.amedd.army.mil

Problem Description:

Currently, 42% of Army recruits are non-deployable (DFC 3) for dental reasons; however 30-50% of first term soldiers deploy upon completion of initial training. On average, it takes 103 days for the DENTACs at FORSCOM installations to correct these non-deployable dental conditions. First Term Dental Readiness (FTDR) is a program designed to complete the dental treatment while the recruit is completing Basic and Advanced Individual Training. The goal of FTDR is to ensure that soldiers sign in to their units ready to deploy on day one. The goal is 95% of initial entry training soldiers are to be in Dental Fitness Class 1 or 2. The plan includes soldiers graduating from AIT, OSUT, and OBC.

The US Army Dental Activity (DENTAC) at various installations has recently implemented phase 1 of the US Army Dental Command's (DENCOM) FDTR plan. In phase 1, the DENTACs are required to provide complete dental exams only to soldiers in Dental Fitness Class 3 (likely to have a dental emergency within 12 months) at Basic Combat Training (BCT), Advanced Individual Training (AIT), One Site Unit Training (OSUT), or the Officer Basic Course (OBC). and treat dental conditions that deem a soldier non-deployable (10K dental exams/year). To move to phase 2, the DENTACs are required to provide a dental exam to all soldiers at Basic Training (40+K dental exams/year).

The problem is finding the appropriate allocation of limited resources (supply) to treat a wavering and usually excessive demand. Due to resource constraints (people, facilities, and equipment), implementation requires phasing. DENCOM's current resources (dentists) cannot manage the needed amount of dental care. Methods need to be developed to alleviate the demand burden.

Proposed Work:

Research students need to collect data, measure throughput, evaluate workload, develop metrics, look at back log, return on investment, payback periods, and define alternative methods that could alleviate the demand burden.

Requirements and Milestones:

- Kick-Off Meeting
- Stakeholder Analysis
- Interim IPRs

Project Deliverables and Due Date*:*

- Final Decision Brief to DENTAC CDR: Due date, May 2006.
- Technical Report: Due date, June 2006.

Senior Investigator: LTC Robert A. Powell, Ph. D., Academy Professor, USMA – Department of Systems Engineering, 845-938-4311

Faculty Analyst(s): TBD

Number of Cadets/Number of Design Teams Involved: 2 Cadet Design teams comprised of: EM Majors to fill the roles of Project Manager and an Economic Analyst; and OR Majors to fill the roles of an Operations Research Analyst and a Systems Engineer.

Supporting Laboratory Technician: Mr. John Melendez

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 120 Hours

Principal Analyst: TBD

Total Cadet Time: Approximately 1400 Hours

Lab Use Hours: IVL 160 Hours

Laboratory Technician Hours: 20 Hours

DoD Research Thrust: (check all that apply)

- □ **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- x **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

First Term Dental Readiness (FTDR) Phase 2

Capstone Research Proposal No.: DSE-CR-0606

Client Organization: U.S. Army Dental Activity (DENTAC) – Fort Jackson, SC

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Matthew T. Williams	DENTAC, Fort Jackson, SC	803-467-1527	Matthew.Williams1@se.amedd.army.mil
COL Larry Rothfuss	HQ, MEDCOM	210-221-7899	Larry.rothfuss@cen.amedd.army.mil

Problem Description:

Currently, 42% of Army recruits are non-deployable (DFC 3) for dental reasons; however 30-50% of first term soldiers deploy upon completion of initial training. On average, it takes 103 days for the DENTACs at FORSCOM installations to correct these non-deployable dental conditions. First Term Dental Readiness (FTDR) is a program designed to complete the dental treatment while the recruit is completing Basic and Advanced Individual Training. The goal of FTDR is to ensure that soldiers sign in to their units ready to deploy on day one. The goal is 95% of initial entry training soldiers are to be in Dental Fitness Class 1 or 2. The plan includes soldiers graduating from AIT, OSUT, and OBC.

The US Army Dental Activity (DENTAC) at various installations has recently implemented phase 1 of the US Army Dental Command's (DENCOM) FDTR plan. In phase 1, the DENTACs are required to provide complete dental exams only to soldiers in Dental Fitness Class 3 (likely to have a dental emergency within 12 months) at Basic Combat Training (BCT), Advanced Individual Training (AIT), One Site Unit Training (OSUT), or the Officer Basic Course (OBC). and treat dental conditions that deem a soldier non-deployable (10K dental exams/year). To move to phase 2, the DENTACs are required to provide a dental exam to all soldiers at Basic Training (40+K dental exams/year).

The problem is finding the appropriate allocation of limited resources (supply) to treat a wavering and usually excessive demand. Due to resource constraints (people, facilities, and equipment), implementation requires phasing. DENCOM's current resources (dentists) cannot manage the needed amount of dental care. Methods need to be developed to alleviate the demand burden.

Proposed Work:

Research students need to collect data, measure throughput, evaluate workload, develop metrics, look at back log, return on investment, payback periods, and define alternative methods that could alleviate the demand burden.

Requirements and Milestones:

- Kick-Off Meeting
- Stakeholder Analysis
- Interim IPRs

Project Deliverables and Due Date*:*

- Final Decision Brief to DENTAC CDR: Due date, May 2006.
- Technical Report: Due date, June 2006.

Senior Investigator: LTC Robert A. Powell, Ph. D., Academy Professor, USMA – Department of Systems Engineering, (845) 938-4311

Faculty Analyst(s): TBD

Number of Cadets/Number of Design Teams Involved: 2 Cadet Design teams comprised of: EM Majors to fill the roles of Project Manager and an Economic Analyst; and OR Majors to fill the roles of an Operations Research Analyst and a Systems Engineer.

Supporting Laboratory Technician: Mr. John Melendez

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 120 Hours

Principal Analyst: TBD

Total Cadet Time: Approximately 1400 Hours

Lab Use Hours: IVL 160 Hours

Laboratory Technician Hours: 20 Hours

DoD Research Thrust: (check all that apply)

- □ **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- x **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

Simulation Studies to Support USMA R-Day Design

Capstone Research Proposal No.: DSE-CR-0608

Client Organization: USCC

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
CPT Chad Goyette	United States Corps of Cadets	(845) 938-3584	Chad.Goyette@us.army.mil

Problem Description:

During academic year 2004-2005, a cadet design team from the USMA Department of Systems Engineering performed a simulation modeling and analysis of R-Day activities in support of the R-Day officer in charge for the United States Corps of Cadets (USCC). This analysis resulted in several recommendations that significantly streamlined the flow and command and control of R-Day when it was executed on 29 June 2005. This success leads to an opportunity to further analyze R-Day activities in support of R-Day 2006. While the 2005 analysis focused on Thayer Hall, USCC has requested future analysis of activities conducted in the cadet area, particularly the issue points. They have also requested an extension of the analysis to include activities conducted on the two days following R-Day.

Proposed Work:

Using an existing model from R-Day 2005 analysis, extend that model to look more in depth at activities conducted in the cadet area on R-Day and on the two days following R-Day. Some of these activities include issue points, cadet drill, the barber shop, and the cadet mess hall. The purpose of this modeling and analysis will be to improve command and control and flow of these activities so that new cadets and cadre have more time to prepare for the R-Day oath ceremony and, on subsequent days, more time for new cadet training.

Requirements and Milestones:

- Problem Definition Complete – 10 October 2004
- Design and Analysis Complete – 19 March 2006
- Decision Making Complete – 21 April 2006
- Implementation Complete – June 2006

Project Deliverables and Due Date*:*

- Interim IPRs: IPR #1 12 September 2005

IPR #2 10 October 2005

IPR #3 17 November 2005

IPR #4 23 January 2006

IPR #5 19 March 2006

- Final Briefing: 21 April 2006
- Technical Report: 27 April 2006

Senior Investigator: LTC Robert Kewley, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, (845) 938-5206

Faculty Analyst(s): LTC Simon Goerger, Ph.D., Assistant Professor & Director, Operations Research Center of Excellence, USMA – Department of Systems Engineering, (845) 938-5535

Number of Cadets/Number of Design Teams Involved: Four cadets enrolled in SE02/403

Supporting Laboratory Technician: John Melendez for the installation and management of ProModel and Logical Decisions licenses on SE lab systems.

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 30 Hours

Principal Analyst: 15 Hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: 100 Hours in any lab with ProModel

Laboratory Technician Hours: 5 Hours

Department Research Thrust Supported: (check all that apply)

- x **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- x **MANNING – the Force**
- x **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- x **TRAINING – the Force**

Integrated Base Defense

Capstone Research Proposal No.: DSE-CR-0609

Client Organization: Army Materiel Command

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Mike Jennings	Night Vision Labs/AMC Fort Belvoir, VA	(703) 704-1032	Mike.Jennings@nvl.army.mil

Problem Description:

Currently, the US Army must provide base defense capabilities in a variety of locations in the United States and overseas. In many cases, particularly for combat support and combat service support bases in hostile environments, the troop requirements for base defense greatly reduce mission capabilities. One potential solution to the problem is to use a combination of existing military and commercial sensors as force multipliers. However, most base and installation commanders do not have the necessary technical training and expertise to employ and integrate the varied and ever-changing array of sensors.

Proposed Work: In order to address this problem, a cadet team from the United States Military Academy Department of Systems Engineering will investigate all aspects of this problem in order to provide base commanders with useful guidance on the deployment and integration of these sensors in different tactical situations. The US Army Military Police School will support this analysis with expertise in force protection doctrine and simulation. This research will potentially allow commanders to provide higher levels of force protection with fewer troops.

Requirements and Milestones:

- Problem Definition Complete – 10 October 2004
- Design and Analysis Complete – 19 March 2006
- Decision Making Complete – 21 April 2006
- Implementation Complete – June 2006

Project Deliverables and Due Date*:*

- Interim IPRs: IPR #1 12 September 2005
  IPR #2 10 October 2005
  IPR #3 17 November 2005
  IPR #4 23 January 2006
  IPR #5 19 March 2006

- Final Briefing: 21 April 2006
- Technical Report: 27 April 2006

Senior Investigator: LTC Robert Kewley, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5206

Number of Cadets/Number of Design Teams Involved: Four cadets enrolled in SE402/403

Supporting Laboratory Technician: John Melendez for the installation and management of necessary modeling software (TBD).

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 30 Hours

Lab Technician: 5 Hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: 100 Hours in labs TBD

Department Research Thrust Supported: (check all that apply)

- x **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- x **MANNING – the Force**
- x **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- x **TRAINING – the Force**

Casualty Assistance Officer Improvement Project

Research Proposal No.: DSE-CR-0610

Client Organization: Army Casualty and Memorial Affairs

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
COL Mary Torgersen	Director, Army Casualty and Memorial Affairs	(703) 325-7777 (DSN: 221)	torgeml@us.army.mil

Problem Description:

To help enhance the process for those assigned the responsibility of being of Casualty Assistance Officer (CAO) so that the primary next-of-kin (PNOK) of deceased soldiers and retirees get timely and responsive assistance.

Proposed Work:

A needs analysis will be conducted to generate possible alternatives to increase the effectiveness of the CAO program. Selection criteria should be developed in order to aid the decision maker in the selection of the best alternative. Finally the selected alternative will be further developed.

Requirements and Milestones: TBD

Project Deliverables and Due Date:

- Interim IPRs: One per semester, expected dates: October, 2005 & March 2006.
- Final Briefing: Due date, May, 2006.
- Technical Report: Due date, May, 2006.

Senior Investigator: LTC Brian Sperling, Ph. D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-4399

Faculty Analyst(s): TBD

Number of Cadets/Number of Design Teams Involved: 4 cadet design team

Supporting Laboratory Technician: TBD

Resources Required for Project: TBD

Research Hours Required (by position):

Senior Investigator: TBD

Principal Analyst: TBD

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: TBD

Laboratory Technician Hours: TBD

DoD Research Thrust: (check all that apply)

- □ **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- x **SUPPORTING – the Force**
- □ **TRAINING – the Force**

CPM UA Supportability Modeling

Capstone Research Proposal No.: DSE-CR-0611

Client Organization: PM Unit of Action Logistics Integration Directorate

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Michael Alter, Operations Manager	Logistics Integration Directorate PM, Unit of Action 6000 6th St, Suite 100, Bldg 1464 Ft. Belvoir, VA 22060	(703) 806-2052 (703) 994-1563 (mobile)	Michael.alter@belvoir.army.mil

Problem Description:

Supportability of the Brigade Combat Team (BCT) relies on a complex system of factors that affect the "time and cost to support." Performance-Based Logistics thinking requires strategies that optimize total system availability which minimizing cost and logistics footprint. The PM UA Logistics Integration Directorate desires cooperative assessment of the state-based Operational Availability (AO) model under development by Sandia National Laboratories, to include an analysis of alternative model inputs and parameters, as well as a formulation of metrics for M&S output. This is follow-on work to that conducted during AY 05.

Proposed Work:

The Department of Systems Engineering will support the PM UA in assessing its BCT supportability M&S effort. Specifically, DSE will:

- Conduct a functional analysis of BCT supportability
- Review and assist in validating the Operational Availability model under development
- Develop metrics for assessing BCT Operational Availability, Life Cycle Costs, and Logistics Footprint.
- Evaluate model outputs and make recommendations for improvements to the model

Requirements and Milestones:

- TBD (cadet capstone project)
- May be extended for 1-3 years and include future AIADs

Project Deliverables and Due Date*:*

- Interim IPRs: October, December, 2004; January, March, 2005
- Final Briefing: May 2005
- Technical Report: June 2005

Senior Investigator: Dr. Paul D. West, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5871.

Number of Cadets/Number of Design Teams Involved: 5 / 1:TBD

Supporting Laboratory Technician: Mr. John Melendez

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 200 hours

Principal Analyst: TBD

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: AMSD, 200 hours

Laboratory Technician Hours: 32 hours

Modeling Human Behavior in Synthetic Environments

Capstone Research Proposal No.: DSE-CR-0612

Client Organization: PM OneSAF

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
LTC Buck Surdu Product Manager	US Army PEO STRI 12350 Research Pkwy Orlando, FL 32826-3276	(407) 384-5103 DSN 970-5103	John.Surdu@us.army.mil

Problem Description:

A significant gap exists between current and desired capabilities for representing human behaviors such as morale and leadership in Army combat simulations. The Program Manager for the Objective OneSAF simulation (OOS) and other simulation proponents desire a methodology for identifying and integrating behaviors in simulation and for assessing their added value to both constructive and virtual simulation analysis.

Proposed Work:

The Department of Systems Engineering will develop a methodology for modeling selected human behaviors, targeting the Objective OneSAF simulation. Specifically, DSE will:

- Identify and prioritize current and desired human behaviors in OOS
- Generate alternatives for low and high-fidelity behavior representation
- Prototype one or more of the alternatives in coordination with stakeholder needs
- Develop an analytical framework for evaluating behaviors

Requirements and Milestones: TBD

Project Deliverables and Due Date:

- Interim IPRs: October, December, 2004; January, March, 2005
- Final Briefing: May 2005
- Technical Report: June 2005

Senior Investigator: Dr. Paul West, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5871.

Number of Cadets/Number of Design Teams Involved: 4/1: TBD

Supporting Laboratory Technician: Mr. Maxim Serebrennik

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 200 hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: AMSD, 200 hours

Laboratory Technician Hours: 32 hours

Lunar Base Logistical Support

Capstone Research Proposal No.: DSE-CR-0613

Client Organization: Systems Analysis & Performance Branch
Space & Vehicle Systems Department
Engineering Directorate
Marshall Space Flight Center (MSFC)
National Aeronautics and Space Administration (NASA)

Point of Contact:

NAME:	ADDRESS:	PHONE:	OTHER:
Mr. Don R. Krupp	EV12 Marshall Space Flight Center Huntsville, AL 35812	256-544-1812	Don.R.Krupp@nasa.gov

Problem Description:

The President committed the country to a manned return to the Moon in a speech in January 2004. NASA's *Vision for Space Exploration* (Feb 04) laid out a plan to start extended human expeditions to the Moon starting no later than 2020. The purpose of these expeditions will be to gather scientific information and to develop technology for manned space flight to Mars and to other destinations.

The astronautical problem of getting to the Moon and back has been well studied, but there has been less work on the level of logistical support required to sustain a long-term human presence in such an extremely isolated and hostile environment. MSFC asked the Department to investigate these logistical requirements. The purpose is to see what useful insights into lunar base logistics can be developed based on Army experience in remote base support, the formal USMA Systems Engineering and Management Process, and the outside perspective of non-specialists.

Proposed Work:

A USMA professor and a cadet spent three weeks at MSFC during the summer of 2005 to do the initial needs analysis for this problem. They scoped the problem, identified some necessary assumptions, produced a functional hierarchy for a lunar base, and completed the needs analysis for the problem. The proposed work is to develop a value model for a lunar base, identify the alternatives for the various base components, and construct a morphological box to enumerate the feasible combinations. Then we will select, justify, and analyze the most promising design for its logistical requirements. If possible, we will construct a network flow (input-output) model of the base, building on the work of Eckart (*Parametric Model of a Lunar Base for Mass and Cost Estimates*, Herbert Utz Verlag Wissenschaft, 1996).

Requirements and Milestones:

- Value Model
- Morphological box of design alternatives
- Point design of moon base
- Logistical analysis
- Network flow model

Project Deliverables and Due Date*:*

- Interim IPRs: Nov 2005, Feb 2006.
- Final Briefing: April 2006.
- Technical Report: August 2006.

Senior Investigator: Dr. Roger C. Burk, Ph. D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4754

Number of Cadets/Number of Design Teams Involved: Cadet design team (two EM majors, one SE major, one OR major).

Supporting Laboratory Technician: TBD

Resources Required for Project*:*

Research Hours Required (by position):

Senior Investigator: 250 hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: TBD

Laboratory Technician Hours: TBD

DoD Research Thrust: (check all that apply)

- □ **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- **x** **TRAINING – the Force**

Flying the Warrior UAV within the National Airspace System

Capstone Research Proposal No.: DSE-CR-0614

Client Organization: PEO Aviation, Redstone Arsenal, AL

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
COL John D. Burke	Project Manager, Army UAV Systems PEO Aviation Redstone Arsenal, AL 35898	256-895-4449	burkejd@tuav.redstone.army.mil
Mr. Jim Charlton	UAVS Project Office PEO Aviation Redstone Arsenal, AL 35898	256- 895-4365	jim.charlton@tuav.redstone.army.mil

Problem Description:

PM UAVS recently awarded a contract for the Extended Range Multipurpose (ERMP) Unmanned Aerial System (UAS) to General Atomics Aeronautical Systems Inc. (GA-ASI). The new system has been nicknamed "Warrior." The Warrior UAS will be used by Division/Corps commanders for RSTA, Communications Relay, and will also be weapons capable. The Warrior UAS will have greater than 24 hr endurance and a range exceeding 300 km. Given the size, performance, range and endurance of the system, the Warrior UAS can reasonably be expected to operate within and require access to the National Airspace System (NAS) and/or the unrestricted airspace of host nations. As such, it must meet equivalent levels of safety as that of general manned aviation. One element of this is the ability to detect, sense and avoid other aircraft. The purpose of this project is to identify Detect, Sense and Avoid requirements and potential technologies necessary for the Warrior ERMP to obtain routine access (i.e., "File & Fly") to the NAS.

Proposed Work:

1. Evaluate the problem and identify appropriate measures of performance to assess the military utility of different payloads
2. Identify and gather data on candidate systems
3. Develop parameter-based spreadsheet model to calculate measures
4. Compare alternatives and make recommendation

Requirements and Milestones: TBD

Project Deliverables and Due Dates:

- IPRs: Oct 05; Dec 05; Feb 06
- Final Briefing: Apr 06
- MORSS Presentation: Jun 06
- Technical Report: Aug 06

Senior Investigator: Dr. Roger C. Burk, Ph. D., Associate Professor–Department of Systems Engineering, USMA, (845) 938-4754

Number of Cadets/Number of Design Teams Involved: One cadet design team of four cadets: one Operations Research major, one Information Systems Engineering major, and two Engineering Management majors

Resources Required for Project*:*

Research Hours Required:

Senior Investigator/Principal Analyst: 136 hours (4 hrs/wk for 2 semesters)

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: TBD

Laboratory Technician Hours: TBD

DoD Research Thrust: (check all that apply)

- x **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

Operational Effectiveness of Sensor Platforms for Supporting Border Patrol Missions

Capstone Research Proposal No.: DSE-CR-0615

Client Organization: Lockheed Martin Transportation & Security Solutions

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	EMAIL:
Mr. Alan Bloodgood, ASI Director	9221 Corporate Blvd. Rockville, Maryland 29334	301-640-2311	alan.bloodgood@lmco.com
Mr. Ernest Angelucci, ASI M&S Lead	9221 Corporate Blvd. Rockville, Maryland 29334	610-531-3566	ernest.angelucci@lmco.com

Background:

Lockheed Martin TS&S is actively preparing to support and respond to Border Security initiatives across the Department of Homeland Security(DHS), Customs and Border Protection (CBP), Office of Border Patrol (BPOBP in all places). It is anticipated that a key objective of these initiatives is to support CBP in establishing and maintaining operational control of the US borders by detecting, responding to and interdicting border penetrations in area deemed high priority due to their threat potential and in accordance with other national security objectives. The primary mission of CBP is to prevent terrorist and terrorist weapons from entering the United States. CBP also retains their traditional mission of preventing illegal aliens, smugglers, narcotics, and other contraband from entering the United States. In preparation for the RFP, we at Lockheed Martin (LM) are currently exploring solution alternatives and design concepts of high operational effectiveness to support these CBP objectives. OBP is within CBP and is responsible for the area between the ports of entry.

We recognize Threat analysis and the analysis of various Ground and Airborne Sensor Platforms (ASPs) as an important component in the overall national border security solution needed to meet new threats and enhance operational performance in current missions. We believe that ASPs can provide the means to achieve real-time status of the border through continuous and uninterrupted surveillance of wide-area Southern border regions to autonomously search, detect, classify and track incursions via both ground and air routes. The ASPs must overcome all weather and cloud cover conditions during day and night operations while covering all terrain types to be fully effective. We believe that the best results are obtained using concepts of an integrated system of platforms and sensors that increase the probability to detection, classification and tracking of border incursions while being able to dynamically intensify surveillance when and where it is needed to respond to specific threats.

Problem Description:

The primary focus on this project is to identify, evaluate, and analyze the operational effectiveness of the various commercially available Ground and ASP systems and concepts that

are applicable to the detection, classification and tracking of border incursions in support to BP missions and objectives as part of an overall threat assessment analysis.

In addition to an operational performance characterization of the viable ASPs against CBP/OBP missions, the results from this project is expected to provide insights into on how to best operationally deploy ASP assets to complement ground assets to achieve optimal operational effectiveness and customer value.

Proposed Work:

Design team executes the following:

- Tasks as defined by SEMP
- Modeling and simulation of representative sensor mix packages focusing on controlling border incursions vicinity Swanton, Vermont and Tucson, Arizona.

Requirements:

Design team provides the following deliverables to the client in the form of a Report:

- All items relevant within the Systems Engineering and Management Process.
- All proposed work items (above paragraph).

Project Deliverables and Tentative Due Date:

IPRs:

- September 2005(Rockville, MD)
- September 2005, (VTC at West Point)
- November 2005
- February 2006

Final Briefing to Client: April 2006

Capstone Brief: May 2006

Final Report: May 2006

Project Advisor: Patrick J. Driscoll, Ph.D., Professor of Operations Research, USMA - Department of Systems Engineering, 845-938-6587

Number of Cadets: Interdisciplinary Team: CDTs Ashley Hahn, Nicholas Linse, Tyler Merritt, Sophia Obamije.

Total Cadet Time: Approximately 1400 hours

Feasibility of Integrating Chemical Protection into the Combat Uniform

Capstone Research Proposal No.: DSE-CR-0616

Client Organization: Joint Program Executive Office for Chemical and Biological Defense (JPEO-CDB)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Deborah Singleton	Joint Program Manager for Individual Protection (JPM-IP) Systems Engineer Joint Program Executive Office for Chemical and Biological Defense (JPEO-CDB) Quantico, VA.	703-884-0539	

Background:

Chemical Biological (CB) warfare agents continue to be a threat to US Armed forces. These include a variety of chemically based nerve, blister and blood agents, various biological toxins and pathogens, as well as Toxic Industrial Chemicals (TICS) and Toxic Industrial Materials (TIMS). In light of the spread of such weapons to third world nations and the potential for such agents to be utilized by terrorist organizations, advances in personal CB protection for the individual warfighter must continue to be pursued to ensure survivability in such a hostile environment. Implementation of protective measures, however, must also take into consideration such aspects as logistic supportability, doctrine, as well as operational suitability and effectiveness. The current trend is to develop and manage the warfighter as a system. In the past equipment was developed independently with limited integration. Likewise warfighter individual equipment was managed independently (example: field uniforms, protective overgarments, weapons, boots, etc.) Under this new paradigm individual warfighter equipment will be developed and managed as a system. This approach shifts the current paradigm by requiring the full integration of all warfighter individual equipment to include the chemical protective ensemble. Currently the protective ensemble is separate from the combat uniform. Emerging technologies may allow the ensemble and the combat uniform to be fully integrated into a single uniform, which meets the needs of the various DoD mission areas. While there are obvious benefits to the integration of the protective ensemble with the duty uniform; for example ensuring that some level of protection is continuously afforded the warfighter; a qualitative cost benefit analysis identifying risk and risk mitigation must be developed. Subsequent modeling that predicts performance to assist unit level commanders must also be developed. This is essential in determining the feasibility of this approach and is necessary prior to investing/committing resources to this end-state solution.

Problem Description:

The desired end state of the next generation chemical protective ensemble is to integrate chemical/biological protection into the duty uniform, gloves and footwear. Intuitively this integration creates effects and issues that could result in performance, operational, logistical,

training and other issues that will require resolution to achieve this end state. Once feasibility is ascertained, a strategy for achieving this goal will have to be developed with clear objectives that capitalize on current and future developments in other areas including decontamination, contamination avoidance, and soldier systems.

Proposed Work:

a. Determine the feasibility associated with integration of chemical protection into the standard duty uniform including the combat boot, combat uniform and gloves.

b. Identify impacts resulting from the integration on performance, logistics, operations, etc. At a minimum address these issues using the DOTMLPF paradigm.

c. Conduct a cost benefit analysis to identify issues and risk associated with the integration. Identify methods to reduce risk. This study should include logistical cost considerations.

d. Develop an incremental strategy to achieve the goal of full integration of chemical protection into the combat uniform. Identify near, mid and long term objectives for the achievement of this goal.

e. Identify emerging and future technologies that will enable the achievement of this goal. Do not limit the study to textile technologies only. Look at technological advancements in areas such as decontamination, contamination avoidance, and future soldier systems that can enable partial or full integration of chemical protection into the combat uniform.

Requirements and Milestones: TBD

Project Deliverables and Due Date*:*

- Interim IPRs: December, 2005.
- Out Briefing to Client: April 2006.
- Technical Presentation at the Capstone Conference: May 2006.
- Technical Report: May 2006.

Senior Investigator: Dr. John E. Kobza, Ph. D., Visiting Professor, USMA – Department of Systems Engineering, (845) 938-2788.

Number of Cadets/Number of Design Teams Involved: Cadet design team (4 or 5 SE majors) TBD.

Total Cadet Time: Approximately 1400 hours

DoD Research Thrust: (check all that apply)

- x **EQUIPPING – the Force**
- □ **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- □ **SUPPORTING – the Force**
- □ **TRAINING – the Force**

Unmanned/Robotic Vehicles

Capstone Research Proposal No.: DSE-CR-0617

Client Organization: Picatinny Arsenal

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Jeff Dyer	Director, Systems Engineering, Analysis and Configuration Management AMSRD-AAR-AIS BLDG1 (2nd Floor) Picatinny Arsenal, NJ 07801	973.724.4707 (com) 973.943.6680 (cell)	jdyer@pica.army.mil

Problem Description:

The Current and Future Force include unmanned vehicles that can be deployed for high-risk jobs demanding endurance and reliability. Unmanned ground vehicles have been used in Iraq and Afghanistan for reconnaissance and explosive ordnance disposal (EOD). However, unmanned vehicle missions can extend well beyond those scenarios to include targeting. There are several issues to be worked regarding their design, development, and employment in operations.

Armed unmanned vehicles – issues with remote versus autonomous control (physical and moral, HITL), safety, how to employ for effectiveness, how to measure value added, TTPs and technology enhancers,

Proposed Work:

Enter Proposed Work (to be discussed with client this week)

Requirements and Milestones:

- Based on above - TBD

Project Deliverables and Due Date:

- Interim IPRs: 23 September 2005, 4 November 2005, 7 December 2005, 27 January 2005, 2 March 2005, 21 April .
- Final Briefing: o/a 10 May 2006.
- Technical Report: June 2006.

Senior Investigator: Dr. Niki C. Goerger, Ph. D., USMA – Department of Systems Engineering, 845-938-3180

Faculty Analyst(s): MAJ Greg Griffin, USMA – Department of Systems Engineering, 845-938-2668.

Number of Cadets/Number of Design Teams Involved: Cadet design team (4).

Supporting Laboratory Technician: Mr. John Melendez, and Mr. Maxim Serebrennik.

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 200 Hours

Other Faculty Analyst: 50 Hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: IVL: 120 Hours

AMSDL: 40 Hours

CSL: 100 Hours

Laboratory Technician Hours: Lab Technician: 30 Hours

DoD Research Thrust: (check all that apply)

- x **EQUIPPING – the Force**
- x **FIGHTING – the Force**
- □ **MANNING – the Force**
- □ **ORGANIZING – the Force**
- x **SUPPORTING – the Force**
- □ **TRAINING – the Force**

A Framework to Test the Validity of Catastrophic Models

Capstone Research Proposal No.: DSE-CR-0618

Client Organization: American International Group, Consultants (AIGC)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Michael Castelli	Senior VP, Safety AIGC 70 Pine Street New York, NY	212-770-7244	michael.castelli@aig.com

Problem Description:

AIG receives many models to analyze the exposure to loss from catastrophes. There is not a good way to decide which ones to use in a given situation.

Proposed Work:

- Review Army and Civilian threat assessments
- Develop baseline terror event scenarios that focus on gas, dirty bombs, poison and terror disruption of key elements of an urban environment
- Develop a framework to test catastrophic models using these scenarios
- Build our own catastrophic assessment model
- Test our model and models submitted by AIG

Requirements and Milestones:

- Fall semester report in December to AIG
- Final report to AIG by April 30, 2006

Project Deliverables and Due Date:

- Interim IPRs: October 2005, December 2005, February 2006
- Final Briefing: May 2006(first or second week)
- Technical Report: By May 1 2006 a report which will describe a general framework to assess the relative usefulness of threat and terror models and then rank the models submitted by AIG

Senior Investigator: LTC Timothy E. Trainor, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-5534

Faculty Analyst(s): Dr. Bobbie Leon Foote, PhD, USMA – Department of Systems Engineering, 845-938-4893.

Number of Cadets/Number of Design Teams Involved: Cadet design team (4 SE majors).

Supporting Laboratory Technician: NA

Resources Required for Project*:*

Research Hours Required (by position)

Senior Investigator: 6 hours

Faculty Analyst: 180 hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: N/A

Technician Hours: N/A

Department Research Thrust Supported: (check all that apply)

- ☐ **ORGANIZING – the Force**
- ☐ **MANNING – the Force**
- x **TRAINING – the Force**
- x **EQUIPPING – the Force**
- ☐ **FIGHTING – the Force**

GIS/Combat Simulation Interoperability

Capstone Research Proposal No.: DSE-CR-0619

Client Organization: USMA Departments of Geography and Environmental Engineering and Systems Engineering

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
LTC Mike Hendricks	Department of Geography and Environmental Engineering United States Military Academy West Point, NY 10996	(845) 938-2472	Michael.Hendricks@usma.edu

Problem Description:

Geographic Information Systems (GIS) provide rich tools for querying environmental features in support of military operations, yet lack the benefits of dynamic interaction over time afforded by state of the art combat simulations. Likewise, simulations generally lack a robust capability to glean information from the environment useful for operations. Knowledge about the incidence of improvised explosive devices (IEDs) in relation to certain cultural features, for example, is a powerful capability of GIS analytical tools that is not linked directly to simulations. Such interoperability may prove invaluable for mission planning and the development of tactics, techniques, and procedures (TTPs).

Proposed Work:

The Department of Systems Engineering will support the PM UA in assessing its BCT supportability M&S effort. Specifically, DSE will:

- Identify GIS capabilities for simulation integration
- Explore the development of "constructed features" derived from actual features and historical incidents such as IED or mortar attacks.
- Explore methodologies for integrating these constructed features with combat simulations
- Evaluate model outputs and make recommendations for improvements to the model

Requirements and Milestones:

- Initial problem statement 15 September 2005
- Needs analysis 15 October 2005
- Formulation of alternatives 15 November 2005
- Interim Project Report 9 December 2005
- Analysis of alternatives 15 March 2006

- Implementation plan 15 April 2006
- Projects Day brief 4 May 2006
- Final Project Report 12 May 2006

Project Deliverables and Due Date*:*

- Interim IPRs: October, December, 2005; January, March, 2006
- Final Briefing: May 2006
- Technical Report: June 2006

Senior Investigator: Dr. Paul D. West, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5871.

Number of Cadets/Number of Design Teams Involved: 4 / 1: CDTs Monte Jones, Elizabeth Yisrael, Matthew Maness, Thomas Ronan

Supporting Laboratory Technician: Mr. Maxim Serebrennik

Resources Required for Project:

Research Hours Required (by position):

Senior Investigator: 200 hours

Principal Analyst:

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: AMSD, 200 hours

Laboratory Technician Hours: 32 hours

The Design and Analysis of ABM Defense Systems that Utilize SCRAMJET Technology (HSHI)

Capstone Research Proposal No.: DSE-CR-0620

Client Organization: Army Aerospace Command (RDE)

Points of Contact (Client):

NAME:	ADDRESS:	PHONE:	OTHER:
Helmut Haas	SAIC, 6725 Odyssey Dr, Huntsville, Ala, 35806	256 864 7048	Helmut.Haas@saicsystems.com
Bob Walker	BAE,310 Voyager Way,,Huntsville, Ala, 35806	256 864 2134	Bob.Walker4@baesystems.com

Problem Description:

Through statutory law the Army has the legal requirement for CONUS missile defense. To accomplish this mission the Army must develop ultra-reliable systems that will identify, track and destroy enemy missile systems. Additionally, the Army must identify dual use capability for the technology, processes and systems developed to meet this vital national mission. Currently, there is no quick and easy methodology, algorithm or model to analyze and evaluate key Anti-Ballistic Missile (ABM) defense system metrics. Likewise, as new technology, such as the SCRAMJET, are developed to support CONUS missile defense and other military missions new metrics must be developed and evaluated in addition to determining appropriate military missions, developing new methodologies and process controls, and develop O & O statements for new transformational military units to deploy these unique systems.

Proposed Work:

- Demonstrate how COTS software can evaluate ABM systems.
- Develop new cost estimating techniques to predict research, testing, development and productions costs of the new FCS systems.
- Teach two capstones with 8 cadets focused on military applications, JCIDS methodology, and new doctrines focused on the novel velocities of SCRAMJET systems.

Requirements and Milestones: TBD

Project Deliverables and Due Date:

- Final report due June 30, 2006.
- Interim reports delivered as appropriate.
- A position paper on the use of Loiter Aircraft in launching interceptors due October 14, 2005.

- Interim IPRs: TBD
- Final Briefing/Technical Report: June 30, 2006

Senior Investigator: LTC Willie J. McFadden III, Ph.D., Associate Professor, USMA – Department of Systems Engineering 845-983-5941.

Faculty Analysts: Dr. Bobbie Leon Foote, Ph.D., Professor, USMA – Department of Systems Engineering, 845-938-4893, Dr. Roger C. Burk, Ph.D., Associate Professor, USMA – Department of Systems Engineering, 845-938-4754, Dr. Paul West, Ph.D., Assistant Professor, USMA – Department of Systems Engineering, 845-938-5871, MAJ Gregory Boylan, M.S., Assistant Professor, Operations Research Center of Excellence, USMA – Department of Systems Engineering, 845-938-3573, MAJ Grant Martin, Assistant Professor, USMA – Department of Systems Engineering, 845-938-5663

Number of Cadets/Number of Design Teams Involved: Cadet design team (8 D/SE majors).

Supporting Laboratory Technician: Max Serebrennik, Software Specialist, USMA – Department of Systems Engineering, 845-938-3688.

Resources Required for Project*:*

Research Hours Required (by position)

Senior Investigator: 180 hours

Principal Analyst: 180 hours

Faculty Analysts: 180 hours

Total Cadet Time: Approximately 1400 hours

Lab Use Hours: 480 hours

Laboratory Technician Hours: 200 hours

DoD Research Thrusts:

- x **ORGANIZING – the Force**
- x **MANNING – the Force**
- x **SUPPORTING – the Force**
- x **TRAINING – the Force**
- x **EQUIPPING – the Force**
- x **FIGHTING – the Force**

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Faculty Analysts in D/Systems, Engineering, Organized by ORCEN

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14. ABSTRACT
The purpose of this document is to formally present the research program of the *U.S. Military Academy Department of Systems Engineering (DSE) and the Operations Research Center for Excellence (ORCEN)* for the Academic Year 05-06. The research plan includes a statement of purpose for research which supports DSE and the ORCEN, a description of the two organizations, a list of the key personnel responsible for executing the plan, and an overview of the annual research cycle.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF: Unclassified			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
					LTC Simon R. Goerger
a. REPORT	**b. ABSTRACT**	**c. THIS PAGE**		120	**19b. TELEPHONE NUMBER** *(include area code)*
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